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(54) **RECORDING AND REPRODUCTION OF A DATA REDUCED DIGITAL VIDEO SIGNAL ON A LONGITUDINAL RECORD CARRIER**

AUFZEICHNUNG UND WIEDERGABE VON DATENREDUZIERTEN DIGITALEN VIDEOSIGNALEN
AUF EINEN LONGITUDINALEN AUFZEICHNUNGSTRÄGER

ENREGISTREMENT ET REPRODUCTION D'UN SIGNAL VIDEO NUMERIQUE SOUS FORME DE
DONNEES REDUITES SUR UN SUPPORT D'ENREGISTREMENT LONGITUDINAL

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(56) References cited:
EP-A- 0 606 857 **EP-A- 0 606 868**
WO-A-95/27977 **DE-A- 3 831 277**
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Description

[0001] The invention relates to a method of recording a data reduced digital video signal in tracks on a longitudinal record carrier, the recording method comprises the steps of

- receiving the data reduced digital video signal,
- writing the data reduced digital video signal in said tracks,

the data reduced digital video signal comprising first signal blocks having data reduced video information obtained from video information of a picture that has been subjected to an intra-picture encoding step, and comprising second signal blocks having data reduced video information obtained from video information of a picture that has been subjected to an inter-picture encoding step, a recording and reproducing arrangement for recording/reproducing a data reduced digital video signal in/from tracks on a longitudinal record carrier and a longitudinal record carrier obtained by the recording arrangement. The invention also relates to an apparatus for retrieving a data reduced digital video signal from a memory, such as a hard disk memory.

[0002] A similar method and arrangements are known from USP 4,807,053 (document (D1) in the list of references that can be found at the end of this application) but in the context of helical scan type recording. The known method and recording arrangement provide a recording of a data reduced digital video signal such that reproduction in a feature or trick mode is possible. Feature or trick modes are those reproduction modes in which the transport speed of the longitudinal record carrier is other than nominal, where the nominal transport speed is the speed at which the data reduced digital video signal was recorded originally. Non-nominal transport speeds are transport speeds higher or lower than the nominal transport speed.

[0003] The invention aims at providing recording and reproducing of a data reduced digital video signal using a recording/reproducing arrangement of the linear recording type. Further, the invention aims at providing recording of a data reduced digital video signal such that reproduction in a feature mode is possible, more specifically, that reproduction during a feature mode with a record carrier speed higher than the nominal speed is possible.

[0004] In accordance with the invention, the method as defined in the opening paragraph is characterized in that the recording method further comprises the steps of recording the data reduced video signal in tracks running in the longitudinal direction of the record carrier,

- generating additional information having a relation to the sequence of the signal blocks in the data reduced video signal and supplying said additional information to at least some of said first and second

signal blocks,

- supplying first signal blocks to first writing means for writing in at least one first track,
- supplying second signal blocks to second writing means for writing in at least one second track, and
- supplying second signal blocks to said first writing means for writing in said at least one first track if a received amount of second signal blocks exceeds a maximum value or if a received amount of first signal blocks drops below a minimum value, or supplying first signal blocks to said second writing means for writing in said at least one second track if a received amount of first signal blocks exceeds a maximum value or if a received amount of second signal blocks drops below a minimum value. The invention is based on the following recognition. Reproduction at a speed higher than nominal is restricted to a certain maximum speed. This maximum speed, amongst others, is determined by the maximum signal processing speed of the electronic circuitry that realize the channel decoding and data expansion that have to be carried out on the information read out from the record carrier during reproduction. By dividing, during recording, the total data reduced video information to be recorded over at least one first and at least one second track, this results in a decrease in data rate in each track, compared to a situation where all information would have been written in one track. Further, the first signal blocks written in the at least one first track will be used during a reproduction in a feature mode. This has the following advantage. Suppose that only one first track and three second tracks are present and that the reproducing arrangement comprises reproduction electronics that require a predetermined clock frequency in order to be able to reproduce the signals read from the four tracks in real time. In the feature reproduction mode, only the signal read from the one first track will be processed by the reproduction electronics. The reproduction electronics could process this signal at a clock frequency which is one quarter of the predetermined clock frequency mentioned above, assuming the record carrier speed being nominal. The record carrier can now be transported at a speed of four times the nominal speed and the reproduction electronics are still capable of processing the signal read from the one first track and having the four times higher data rate, when the reproduction electronics have the predetermined clock frequency.

[0005] Further, the first signal blocks read from the at least one first track can be decoded (that is: data expanded) simply, as they contain video information of a picture that has been subjected to an intra-picture encoding step prior to recording. So, the video information corresponding to a picture can be decoded by itself, without the need of additional information relating to an-

other picture so as to obtain a reproduced picture.

[0006] The second signal blocks will (generally) be written in the at least one second track. In order to obtain an equal quantity of the signals recorded in both the at least one first track and the at least one second track, it may thus be necessary to write second signal blocks also in the at least one first track or first signal blocks in the at least one second track also.

[0007] The data reduced digital video signal may be a video signal of the MPEG type, the first signal blocks in the data reduced digital video signal comprising intra picture encoded video information of the I type.

[0008] The draft Grand Alliance HDTV System Specification dated February 22, 1994, document (D2) in the list of references, more specifically the chapter III of this specification, describes a video compression system for obtaining a data reduced video signal of the MPEG type. The data reduced video signal so obtained comprises a sequence of so-called I-, P- and B-frames. The I-frames each comprise data reduced video information corresponding to a picture that has been encoded in an intra picture encoding step. The P-frames each comprise data reduced video information corresponding to a picture that has been encoded in a predictive (or: uni-directional) inter picture encoding step. The B-frames each comprise data reduced video information corresponding to a picture that has been encoded in a bidirectional inter picture encoding step.

[0009] Reproduction in a feature mode can now be realized on the basis of the first signal blocks read from the at least one first track, that comprise the data reduced video information comprised in I-frames of the MPEG-type video signal.

[0010] Second signal blocks may comprise inter picture encoded video information of the P type or may comprise bi-directionally inter-picture encoded information of the B type. As a result, the second signal blocks are normally recorded in the at least one second track. In the situation where second signal blocks are recorded in the at least one first track, those second signal blocks are however not used during reproduction in a feature mode where the record carrier velocity is higher than nominal.

[0011] The method may be further characterized in that the data reduced video signal further comprises third signal blocks having data reduced video information obtained from video information of a picture that has been subjected to a bi-directional inter-picture encoding step, the method further comprising the steps of

- supplying the third signal blocks to said writing means, and
- writing said third signal blocks in a track on the record carrier. Also in this case, the data reduced video signal may be a video signal of the MPEG type, the data reduced video signal is a video signal of the MPEG type, the first signal blocks in the data reduced digital video signal comprising intra picture

encoded video information of the I type, the second signal blocks in the data reduced digital video signal comprising inter picture encoded video information of the P type and the third signal blocks in the data reduced digital video signal comprising bi-directionally inter-picture encoded information of the B type.

In this embodiment, the signal blocks comprising bi-directionally inter-picture encoded information of the B type are now separately identified as third signal blocks. Again, the third signal blocks may normally be written in the at least one second track, or may be written in the at least one first track.

[0012] In another embodiment, the third signal blocks are normally written in at least one third track. Again, third signal blocks may be written in the at least one first track or the at least one second track.

[0013] The recording arrangement for recording the data reduced digital video signal in tracks on a longitudinal record carrier comprises

- an input terminal for receiving the data reduced digital video signal,
- writing means for writing the data reduced digital video signal in said tracks,

the data reduced digital video signal comprising first signal blocks having data reduced video information obtained from video information of a picture that has been subjected to an intra-picture encoding step, and comprising second signal blocks having data reduced video information obtained from video information of a picture that has been subjected to an inter-picture encoding step, is characterized in that the recording arrangement is a recording arrangement of the linear recording type, the writing means comprising first writing means for writing information in at least one first track running in the longitudinal direction of the record carrier and second writing means for writing information in at least one second track running in the longitudinal direction on the record carrier, additional information generator means being present for generating additional information having a relation to the sequence of the signal blocks in the data reduced video signal, combining means being present for supplying said additional information to at least some of said first and second signal blocks, multiplexer means adapted to supply first signal blocks to said first writing means for writing in said at least one first track, and also adapted to supply second signal blocks to said second writing means for writing in said at least one second track, the multiplexer means further being adapted to supply first signal blocks to said second writing means for writing in said at least one second track if a received amount of first signal blocks exceeds a maximum value or if a received amount of second signal blocks drops below a minimum value, or to supply second signal blocks to said first writing means for writing in said at least one first track if a received amount

of second signal blocks exceeds a maximum value or if a received amount of first signal blocks drops below a minimum value, so as to have the data quantity recorded in said at least one first track and said at least one second track substantially constant. The dependent recording arrangement claims define further embodiments of the recording arrangement in accordance with the invention.

[0014] The reproducing arrangement for reproducing the data reduced digital video signal, recorded in tracks on a longitudinal record carrier comprises :

- reading means for reading the data reduced digital video signal from said tracks,
- an output terminal for supplying the data reduced digital video signal,

the data reduced digital video signal comprising first signal blocks having data reduced video information obtained from video information of a picture that has been subjected to an intra-picture encoding step prior to recording, and comprising second signal blocks having data reduced video information obtained from video information of a picture that has been subjected to an inter-picture encoding step prior to recording, is characterized in that the reproducing arrangement is a reproducing arrangement of the linear reproducing type, the reading means comprising first reading means for reading information recorded in at least one first track running in the longitudinal direction of the record carrier and second reading means for reading information recorded in at least one second track running in the longitudinal direction on the record carrier, the first reading means being adapted to read first signal blocks and second signal blocks, if present, from said at least one first track, the second reading means being adapted to read first signal blocks, if present, and second signal blocks from said at least one second track, detection means being present for detecting additional information which has a relation to the sequence of the signal blocks in the data reduced video signal prior to recording, which additional information has been stored in at least some of said first and second signal blocks prior to recording, combination means being present for combining in a 'normal play' reproduction mode, the first signal blocks and the second signal blocks in response to said detected additional information, so as to obtain a first replica of said data reduced digital video signal, and that in a 'trick play' reproduction mode, the combination means are further adapted to retrieve the first signal blocks read from said at least one first track only so as to obtain a second replica of said data reduced digital video signal.

[0015] An embodiment of the reproducing arrangement for reproducing the data reduced digital video signal, recorded in a track on a longitudinal record carrier in a feature mode with the record carrier speed being larger than nominal, is characterized in that the reading means comprises

- a reading head for reading information from the track,
- memory means for storing information read from the track with a first rate and reading out said information with a second rate, said second rate being lower than said first rate,
- detection means for detecting the start of a first signal block present in the signal read from the track,
- address generating means for generating read-in addresses at said first rate, and for generating read-out addresses at said second rate,
- comparator means for comparing a filling degree of the memory means with a threshold value (T_a),

that the reading means are adapted to carry out the following steps,

(a) the address generating means are adapted to generate subsequent read-in addresses at said first rate and read-out addresses at said second rate, starting with a start address, for storing the information in and reading the information from subsequent storage locations in said memory means,

(b) that upon the detection of the start of a first signal block present in the information read out from the memory by the detection means, an enable signal is generated so as to enable the decoding unit to start decoding the information corresponding to said first signal block,

(c) that upon detection of the current filling degree being larger than or equal to said threshold value, the storage of information in said memory means is terminated, and that the reading means are adapted to return to

(a) in response to termination of the decoding of said first signal block.

This embodiment enables the reproduction with a speed which is much higher than allowed for by the clock frequency of the decoder means, in that, on an irregular basis, packets of information, corresponding to a first signal block (or an I-frame, in the case of an MPEG video signal), are read-out and processed at the much lower clock frequency by the decoder means.

[0016] Further, reference is made to EP-A-O 606857 and WO-A-95/27977. As far as a recording/reproducing arrangement has been described in those documents, they both relate to a helical scan recording/reproducing arrangement. In those documents, during recording, a trick play signal is generated by retrieving I frame information from an MPEG video information signal received for recording. The trick play signal is combined with the MPEG video information signal into a composite signal and recorded on the record carrier so as to form helical tracks.

[0017] These and other aspects of the invention will be further elucidated in the accompanying figure description. In the figure description shows

figure 1 a number of subsequent pictures that have been encoded so as to obtain a data reduced video signal,

figure 2a the serial datastream of the data reduced video signal, which is in the form of a video signal of the MPEG type,

figure 2b the serial datastream of figure 2a, subdivided into signal blocks of constant length,

figure 3 a first embodiment of the recording arrangement,

figure 4 a further elaboration of one of the elements in the recording arrangement of figure 3,

figure 5 another elaboration of the said element,

figure 6 a second embodiment of the recording arrangement,

figure 7 an embodiment of the record carrier,

figure 8 a first embodiment of the reproducing arrangement,

figure 9 an elaboration of the detector in the reproducing arrangement of figure 8,

figure 10 another elaboration of the detector,

figure 11 a second embodiment of the reproducing arrangement,

figure 12 an elaboration of the detector in the reproducing arrangement of figure 11,

figure 13 another elaboration of the said detector,

figure 14 a further elaboration of the arrangement of figure 8, when used in a feature mode,

figure 15 the signal obtained with the embodiment of figure 14,

figure 16 a further elaboration of the arrangement of figure 11, when used in a feature mode,

figure 17 an embodiment of an arrangement for storing I-frame information in a memory during a feature mode, and

figure 18 a flow diagram of a method for storing the I-frame information in the memory with the arrangement of figure 17.

[0018] Figure 1 shows schematically a number of subsequent pictures denoted a_1 to a_{10} . A data reduction step need to be carried out on the picture information before the video information corresponding to the pictures is recorded on a record carrier. On the video information corresponding to the picture a_2 an intra picture encoding step has been carried. Such intra picture encoding step is well known in the art. When included in the MPEG video signal, the data reduced video information corresponding to the picture a_2 is comprised in a so-called I-frame of the MPEG video signal. Upon decoding (that is: data expansion), a replica of the picture a_2 can be obtained using the information comprised in the I-frame corresponding to the picture a_2 alone.

[0019] On the video information corresponding to the picture a_5 an inter picture encoding step has been carried. Such inter picture encoding step is well known in the art, and requires (in the present example) the picture a_2 to enable the inter picture encoding step. When in-

cluded in the MPEG video signal, the data reduced video information corresponding to the picture a_5 is comprised in a so-called P-frame of the MPEG video signal. Upon decoding, a replica of the picture a_5 can be obtained using the information comprised in the P-frame corresponding to the picture a_5 and the decoded information of the picture a_2 . This dependency is indicated in figure 1 by means of the arrow p_1 .

[0020] On the video information corresponding to the picture a_3 a bi-directional inter picture encoding step has been carried. Such bi-directional inter picture encoding step is well known in the art, and requires (in the present example) the pictures a_2 and a_5 to enable the bi-directional inter picture encoding step. When included in the MPEG video signal, the data reduced video information corresponding to the picture a_3 is comprised in a so-called B-frame of the MPEG video signal. Upon decoding, a replica of the picture a_3 can be obtained using the information comprised in the B-frame corresponding to the picture a_3 , as well as the decoded information of the pictures a_5 and a_2 . This dependency is indicated in figure 1 by means of the arrows p_2 and p_3 .

[0021] On the video information corresponding to the picture a_4 a bi-directional inter picture encoding step has been carried. This encoding step again requires (in the present example) the pictures a_2 and a_5 to enable the bi-directional inter picture encoding step. When included in the MPEG video signal, the data reduced video information corresponding to the picture a_4 is comprised in a so-called B-frame of the MPEG video signal. Upon decoding, a replica of the picture a_4 can be obtained using the information comprised in the B-frame corresponding to the picture a_4 , as well as the decoded information of the pictures a_5 and a_2 . This dependency is indicated in figure 1 by means of the arrows p_4 and p_5 .

[0022] On the video information corresponding to the picture a_8 an inter picture encoding step has been carried. Such inter picture encoding step is well known in the art, and requires (in the present example) the picture a_5 to enable the inter picture encoding step. When included in the MPEG video signal, the data reduced video information corresponding to the picture a_5 is comprised in a so-called P-frame of the MPEG video signal. Upon decoding, a replica of the picture a_8 can be obtained using the information comprised in the P-frame corresponding to the picture a_8 and the decoded information of the picture a_5 . This dependency is indicated in figure 1 by means of the arrow p_6 .

[0023] Bi-directional inter picture encoding steps have been carried on the pictures a_6 and a_7 . These encoding steps require (in the present example) in both cases the pictures a_5 and a_8 to enable the bi-directional inter picture encoding step. When included in the MPEG video signal, the data reduced video information corresponding to each of the pictures a_6 and a_7 is comprised in a B-frame, as indicated in figure 1. Upon decoding, replicas of the picture a_6 and a_7 can be obtained using the information comprised in the B-frame corresponding

to the picture a_6 and a_7 respectively and the decoded information of the pictures a_5 and a_8 . This dependency is indicated in figure 1 by means of the arrows p_7 , p_8 and p_9 , p_{10} respectively.

[0024] If the picture a_{11} is encoded into a P-frame, the arrow p_{11} indicates the dependency of the picture a_{11} from the picture a_8 upon decoding of the picture a_{11} . If the picture a_{11} is encoded into an I-frame, no such dependency is present. Either encoded into an I-frame, or encoded into a P-frame, the pictures a_9 and a_{10} are dependent of the pictures a_8 and a_{11} for their decoding. These dependencies are indicated by the arrows p_{12} , p_{13} and p_{14} and p_{15} respectively.

[0025] It can be concluded from figure 1 that P-frames are dependent on either a previous P-frame or a previous I-frame. B frames are dependent on either a previous I-frame and a subsequent P-frame, or a previous P-frame and a subsequent P-frame, or a previous P-frame and a subsequent I-frame or a previous I-frame and a subsequent I-frame, if such a sequence exists.

[0026] The serial datastream of the MPEG signal obtained from the sequence of pictures a_1 to a_{10} after MPEG encoding (data compression), is shown in figure 2a, where frames F_1 to F_8 are visible. Each frame comprises the data reduced video information corresponding to a picture. Frame F_1 is a B-frame and comprises data reduced video information corresponding to the picture a_1 . Frame F_2 is an I-frame and comprises data reduced video information corresponding to the picture a_2 . Frame F_3 is a B-frame and comprises data reduced video information corresponding to the picture a_3 , and so on.

[0027] Figure 2b shows how the serial datastream of the MPEG video signal is subdivided into a sequence of signal blocks of equal length prior to recording on a longitudinal record carrier. As can be seen in figure 2a, the boundary between the frames F_1 and F_2 falls within the signal block S_i , the boundary between the frames F_2 and F_3 occurs within the signal block S_j , the boundary between the frames F_3 and F_4 occurs within the signal block S_k , the boundary between the frames F_4 and F_5 occurs within the signal block S_l , the boundary between the frames F_5 and F_6 occurs within the signal block S_m and the boundary between the frames F_{10} and F_{11} occurs within the signal block S_n . It is assumed that the frame F_{11} is an I-frame.

[0028] In accordance with the foregoing, the signal blocks S_i to S_j inclusive are identified as 'first signal blocks', as they comprise I-frame information. In the same way, the signal blocks S_n to S_p inclusive are identified as 'first signal blocks'. In a first embodiment, see figure 3, where the signal blocks are divided over only one first track T_1 and only one second track T_2 , the other signal blocks are identified as 'second signal blocks'.

[0029] Figure 3 shows an embodiment of the recording arrangement in accordance with the invention. An input terminal 1 is coupled to a fixed terminal, denoted 'a', of a switch 2 and to an input of a detector 3. A terminal

denoted 'b' of the switch 2 is coupled to an input of a buffer 6, which can be in the form of a FIFO. An output of the buffer 6 is coupled, via a well known channel encoder (not shown), to a writing head 8 for writing information in a first track T_1 on the record carrier 10, of which only a part is shown. A terminal denoted 'c' of the switch 2 is coupled to an input of a buffer 14, which can be in the form of a FIFO. An output of the buffer 14 is coupled, via a channel encoder (not shown), to a writing head 16 for writing information in a second track T_2 on the record carrier 10. A detector 3 is present having an input coupled to the input terminal 1 and an output coupled to a first input 21 of a combining unit 18. Filling degree determining means 20 are present for determining the filling degree of the buffers 6 and 14. An output of the filling degree determining means 20 is coupled to a second input 23 of the combining unit 18, and output of which is coupled to a switching signal input of the switch 2.

[0030] It is assumed that the recording starts when an I-frame, such as the frame F_2 , is received.

[0031] The detector 3 detects, for portions in the serial datastream of the MPEG signal received (those portions are the signal blocks indicated in figure 2b), whether the portions contain information coming from an I-frame or not. Upon detecting a signal block comprising I-frame information, that is the first signal block S_i (see figure 2b), the detector 3 generates a first control signal which is applied to the combining unit 18. In response to the first control signal, the combining unit 18 generates a first switching signal which is applied to the switch 2. In response to the said first switching signal, the switch is switched into the position a-b. As a result, the first signal blocks S_i , S_{i+1} , S_{i+2} , ... etc. are applied to the buffer 6 and subsequently written in the track T_1 by the head 8. Recording continues until the detector 3 detects that the signal block S_{j+1} comprises 'non I-frame' information, see also figure 2b. The detector 3 now generates a second control signal which is applied to the combining unit 18. In response to the second control signal, the combining unit 18 generates a second switching signal which is applied to the switch 2. In response to the said second switching signal, the switch is switched into the position a-c. As a result, the second signal blocks S_{j+1} , S_{j+2} , S_{j+3} , ... etc. are applied to the buffer 14 and subsequently written in the track T_2 by the head 16. Recording continues until the detector 3 detects that the signal block S_n comprises I-frame information, see figure 2b. The detector 3 again generates a first control signal which is applied to the combining unit 18, the switch is switched into the position a-b. As a result, the first signal blocks S_n , S_{n+1} , S_{n+2} , ... to S_p are applied to the buffer 6 and subsequently written in the track T_1 by the head 8. Upon detection of the fact that the signal block S_{p+1} comprises 'non I-frame' information, see figure 2b, by the detector 3, the switch is switched into the position a-c. As a result, the second signal blocks S_{p+1} , S_{p+2} , S_{p+3} , ... etc. are applied to the buffer 14 and subsequently written in the track T_2 by the head 16.

[0032] As the information to be written in the tracks T_1 and T_2 are supplied by the switch 2 on a discontinuous basis, the buffers 6 and 14 are needed so as to enable a continuous recording of information in the tracks T_1 and T_2 . It may however occur that, with the switch 2 in the position a-c, the buffer 6 may become empty, or the buffer 14 may become completely full. This should be avoided, as this results in no information being recorded in the track T_1 or information for recording in the track T_2 being lost respectively.

[0033] The filling degree determining means 20 now compare the filling degree of the buffers with a predetermined minimum and maximum filling degree level.

[0034] In response to either the filling degree of the buffer 6 becoming lower than said predetermined minimum filling degree level, or the filling degree of the buffer 14 becoming larger than said predetermined maximum filling degree level, the means 20 generate a first detection signal and supply the first detection signal to the second input 23 of the combining unit 18. In response to said first detection signal, the combining unit 18 now generates a switching control signal to the switch 2 such that, although second signal blocks are applied to the input 1 and thus a second control signal is supplied by the detector 3, the switch is positioned in the a-b position. The switching over between the position a-c and the position a-b should preferably take place at the boundaries of signal blocks.

[0035] Conversely, if the switch 2 in the position a-b, the buffer 6 may become completely filled, or the buffer 14 may become empty. This should also be avoided, as this results in no information being recorded in the track T_2 or information for recording in the track T_1 being lost respectively.

[0036] In response to either the filling degree of the buffer 14 becoming lower than said predetermined minimum filling degree level, or the filling degree of the buffer 6 becoming larger than said predetermined maximum filling degree level, the means 20 generate a second detection signal and supply the second detection signal to the second input 23 of the combining unit 18. In response to said second detection signal, the combining unit 18 now generates a switching control signal to the switch 2 such that the switching position is changed from a-b to a-c. The switching over from the position a-b to the position a-c should preferably take place at the boundaries of signal blocks. More specifically, if first signal blocks are applied to the input 3, so that the detector 3 supplies a first control signal, the switching over from the position a-b to a-c may be delayed until the detection of the first second signal block in the serial datastream, if the total memory space available in the buffer 6 enables a continued storage of information in the buffer 6.

[0037] In order to enable a reproduction of the information recorded in the two tracks T_1 and T_2 , it will be needed to insert 'some sequence number information' in the datastream supplied to the heads 8 and 16. This is realized by the block denoted 25 in figure 3.

[0038] One embodiment of the block 25 is shown in figure 4. The block in figure 4, denoted by 25' comprises a sequence number generator 30 and a combining unit 31. The generator 30 generates a sequence of subsequent numbers with a rate equal to the rate with which the signal blocks S_i are applied to the input terminal 1. The combining unit 31 now inserts a sequence number in each one of the signal blocks.

[0039] In a modified version, the sequence of signal blocks that are applied to one of the buffers between two switchings over of the switch 2, receive the same sequence number. After a switching over of the switch to the other position, the next sequence of signal blocks receive a subsequent sequence number, until the next switching over occurs. Again the sequence number is increased and the next sequence of signal blocks receive the increased sequence number.

[0040] In again another modified version, only the signal blocks directly following the switching over of the switch 2 to the other position receive a sequence number.

[0041] Another embodiment of the block 25 is shown in figure 5. The block in figure 5, denoted by 25" comprises a flag signal generator 35 and a combining unit 36. Further, the combining unit 18 of figure 3 is of a slightly different construction and is denoted 18' in figure 5. The combining unit 18' has a further output 38 which is coupled to a control signal input 40 of the flag signal generator 35. The combining unit 18' generates a signal at its output 38 indicating the position of the switch 2 or generating a signal indicating that the position of the switch changes. The generator 35 generates in response to the signal applied to the input 40, a flag signal indicating that the switch position is changed. A flag signal is only stored in the signal block that is applied to the buffer 6 at first after switching over from the position a-c to the position a-b, and a flag signal is only stored in the signal block that is applied to the buffer 14 at first after switching over from the position a-b to the position a-c.

[0042] In a modification of this embodiment, the last signal block applied to an encoder receives the flag signal. In the example of figure 2b, those are the signal blocks $S_j, S_{j-1}, S_m, \dots, S_{n-1}, \dots$

[0043] It should be noted here, that the insertion of the sequence number information or the flag signal information need not necessarily take place before the switch 2. It may be possible to insert the sequence number information or the flag signal information in the signal blocks after the switch.

[0044] Figure 6 shows another embodiment of the recording arrangement. The arrangement shows large resemblances with the embodiment of figure 3. Therefore, identical elements present in both embodiments have the same reference number. The embodiment of figure 6 further comprises a buffer 43 and a writing head 45. The switch is slightly different and is denoted by 2'. It has a terminal d, which is coupled to an input of the buff-

er 43. The head 45 is adapted to write information supplied by the buffer 43 and encoded in a channel encoder (not shown) in a third track T_3 on the record carrier 10'.

[0045] Again, it can be said that the recording starts when an I-frame, such as the frame F_2 in figure 2a, is received.

[0046] The detector 3' detects, for signal blocks in the serial datastream applied to the input 1, whether the signal blocks contain information coming from an I-frame, or contain information coming from a P-frame or contain information coming from a B-frame. Upon detecting a signal block comprising I-frame information, that is the first signal block S_i (see figure 2b), the detector 3' generates a first control signal which is applied to the combining unit 18". In response to the first control signal, the combining unit 18" generates a first switching signal which is applied to the switch 2'. In response to the said first switching signal, the switch is switched into the position a-b. As a result, the first signal blocks S_i , S_{i+1} , S_{i+2} , ... etc. are applied to the buffer 6 and subsequently written in the track T_1 by the head 8. Recording continues until the detector 3' detects that the signal block S_{j+1} comprises B-frame information, see also figure 2b. The detector 3' now generates a third control signal which is applied to the combining unit 18". In response to the third control signal, the combining unit 18" generates a third switching signal which is applied to the switch 2'. In response to the said third switching signal, the switch is switched into the position a-d. As a result, the second signal blocks S_{j+1} , S_{j+2} , S_{j+3} , ... etc. are applied to the buffer 43 and subsequently written in the track T_3 by the head 45. Recording continues until the detector 3' detects that the signal block S_l comprises P-frame information, see figure 2b. The detector 3' generates a second control signal which is applied to the combining unit 18", the switch is switched into the position a-c. As a result, the second signal blocks S_1 , S_{1+1} , S_{1+2} , ... to S_m are applied to the buffer 14 and subsequently written in the track T_2 by the head 16. Upon detection of the fact that the signal block S_{m+1} comprises B-frame information, see figure 2b, by the detector 3', the switch is switched into the position a-d. As a result, the third signal blocks S_{m+1} , S_{m+2} , S_{m+3} , ... etc. are applied to the buffer 43 and subsequently written in the track T_3 by the head 45.

[0047] The filling degree determining means 20' now compare the filling degree of the buffers 6, 14 and 43 with a predetermined minimum and maximum filling degree level.

[0048] In response to the filling degree of the buffer 6 becoming lower than said predetermined minimum filling degree level, it will be necessary to apply either second signal blocks or third signal blocks, or both to the buffer 6, for recording in the track T_1 . In response to the filling degree of the buffer 14 becoming lower than said predetermined minimum filling degree level, it will be necessary to apply either first signal blocks or third signal blocks, or both to the buffer 14, for recording in the

track T_2 . In response to the filling degree of the buffer 43 becoming lower than said predetermined minimum filling degree level, it will be necessary to apply either first signal blocks or second signal blocks, or both to the buffer 43, for recording in the track T_3 .

[0049] Further, in response to the filling degree of the buffer 6 becoming larger than said predetermined maximum filling degree level, it will be necessary to apply first signal blocks to either the buffer 14 or the buffer 43 for recording in either the track T_2 or the track T_3 respectively. In response to the filling degree of the buffer 14 becoming larger than said predetermined maximum filling degree level, it will be necessary to apply second signal blocks to either the buffer 6 or the buffer 43 for recording in either the track T_1 or the track T_3 respectively. In response to the filling degree of the buffer 43 becoming larger than said predetermined maximum filling degree level, it will be necessary to apply third signal blocks to either the buffer 6 or the buffer 14 for recording in either the track T_1 or the track T_2 respectively.

[0050] The means 20' generate a control signal in response to one of the situations mentioned above. In response to such control signal, the combining unit 18" generates a corresponding switching signal to the switch 2' so that it is switched into the required position.

[0051] In order to enable a reproduction of the information recorded in the three tracks T_1 , T_2 and T_3 , it will be needed to insert 'some sequence number information' in the datastream supplied to the heads 8, 16 and 45. This is realized by the block denoted 25a in figure 6.

[0052] One embodiment of the block 25a equals the embodiment of the block 25' of figure 4. In this embodiment, a sequence number is inserted in each of the signal blocks or in only specific signal blocks, such as the signal blocks directly following the switching over of the switch 2' to another position.

[0053] Another embodiment of the block 25a is equivalent to the embodiment shown in figure 5, so that it requires a combining unit 18" provided with the output 38 which is shown in figure 5. The flag signal generator 35 now may generate in response to the signal applied to the input 40, a flag signal indicating that the switch 2' is switched into another position. Moreover, the flag signal indicates to which position the switch should be positioned. Consequently, the flag signal generator 35 generates a first flag signal if the switch is switched into the position a-b, a second flag signal indicating that the switch 2' is switched into the position a-c or a third flag signal indicating that the switch 2' is switched into the position a-d.

[0054] During the application of the signal blocks S_i to S_j to the buffer 6, see figure 2b, a third flag signal is stored in the last signal block that is applied to the buffer 6: that is the signal block S_j . Now the signal blocks S_{j+1} to S_{l-1} are applied to the buffer 43. Next, the second flag signal is stored in the last signal block that is applied to the buffer 43: that is the signal block S_{l-1} . Next, a third flag signal is supplied to the signal block S_m , which is

the last signal block applied to the buffer 14. This is continued until the first flag signal is stored in the signal block S_{n-1} .

[0055] It should also be noted here, that the insertion of the sequence number information or the flag signal information need not necessarily take place before the switch 2'. It may be possible to insert the sequence number information or the flag signal information in the signal blocks after the switch.

[0056] Other embodiments of the recording arrangement are possible, such as the embodiment of figure 3, where the channel signal provided by the buffer 6 is divided over and stored in two or more first tracks $T_{1,1}$, $T_{1,2}$, $T_{1,3}$, ... and the channel signal provided by the buffer 14 is divided over and stored in two or more second tracks $T_{2,1}$, $T_{2,2}$, $T_{2,3}$, ..., see figure 7, which shows an embodiment of a record carrier 10" having the said tracks recorded on it.

[0057] In an equivalent way, the embodiment of figure 6 could have been modified by dividing the each channel signal provided by one or more of the buffers 6, 14 and 43 over two or more tracks that run parallel to each other in the length direction of the record carrier.

[0058] Figure 8 shows an embodiment of the reproducing arrangement in accordance with the invention, for reproducing information from a first track T_1 and a second track T_2 on the record carrier 10, which has been obtained by the recording arrangement of figure 3. Read heads 50 and 51 are present for reading information from the first track T_1 and the second track T_2 respectively of the record carrier 10. Outputs of the read heads 50 and 51 are coupled, via well known channel decoder circuitry (not shown), to inputs of buffers 56 and 57 respectively. Outputs of the buffers 56 and 57 are coupled to a terminal b and c respectively of a switch 58. The buffers 56 and 57 may be in the form of a FIFO. A fixed terminal a of the switch 58 is coupled to an output terminal 63 of the arrangement. Further, a detector 60 is present having inputs 65 and 66 coupled to the outputs of the buffers 56 and 57 respectively. An output 61 of the detector 60 is coupled to a switching control input of the switch 58. The detector 60 generates a switching control signal at its output 61 so as to control the position of the switch 58.

[0059] Signal blocks are read from the tracks T_1 and T_2 by the heads 50 and 51 and are supplied to the buffers 56 and 57 respectively.

[0060] In one embodiment of the detector 60, shown in figure 9, the detector detects the sequence numbers that are stored in each of the signal blocks. The detector of figure 9 comprises sequence number extractors 70 and 71 having inputs coupled to the inputs 65 and 66 respectively of the detector 60. Outputs of the extractors 70 and 71 are coupled to respective inputs of a comparator 72, an output of which is coupled to the output of the detector 60. The comparator 72 compares the sequence numbers extracted from the signal blocks obtained from the buffer 56 with the sequence numbers

extracted from the signal blocks obtained from the buffer 57. If the sequence number of a signal block present at the output of the buffer 56 is smaller than the sequence number of the block present at the output of the buffer 57, the comparator 72 generates a first switching control signal, which results in the switch 58 being positioned in the position b-a. This is the case when (replicas of) the signal blocks S_i to S_j , see figure 2b, are supplied by the buffer 56 and (the replica of) the signal block S_{j+1} is present (and waits) at the output of the buffer 57.

[0061] As it is assumed that reproduction starts with the reproduction of signal blocks having I-frame information, the switch 58 is thus initially positioned in the position b-a.

[0062] First signal blocks are continuously supplied to the output of the buffer 56 and supplied to the output terminal 63, until the signal block S_j is supplied to the output. The next signal block at the output of buffer 56 is the signal block S_n , see figure 2b. The comparator 72 now detects that the sequence number of the signal block S_n supplied by the extractor 70 is larger than the sequence number of the signal block S_{j+1} , so that the comparator generates a second switching signal at its output. Under the influence of this signal, the switch is switched to the c-a position. The outputting of signal blocks from the buffer 56 is now stopped and the buffer 57 now outputs signal blocks which signal blocks are applied to the output terminal 63. After having output the signal block S_{n-1} , see figure 2b, the comparator detects that the sequence number of the signal block S_n present and waiting at the output of the buffer 56 is smaller than the sequence number of the signal block present at that instant (probably, this is the signal block S_{p+1}) at the output of the buffer 57. As a result, the first switching signal is generated and the switch 58 is switched to the b-a position. In this way, the original sequence of the signal blocks is reconstructed.

[0063] The above described embodiment of the detector 60 also functions properly for the modified version in which, during recording, see figure 3, the sequence of signal blocks that are applied to one of the tracks between two switchings over of the switch 2, receive the same sequence number, and for the other modified version in which during recording, only the signal blocks directly following the switching over of the switch 2 to the other position receive a sequence number.

[0064] Another embodiment of the detector 60 is shown in figure 10. The detector in figure 10, denoted by 60' comprises flag signal detectors 75 and 76 having inputs coupled to the inputs 65 and 66 respectively of the detector 60'. Outputs of the detectors 75 and 76 are coupled to corresponding inputs of a switching control signal generator 78.

[0065] During reproducing the first signal blocks S_i to S_j , see figure 2b, the switch 58 is in the position b-a and the signal blocks are supplied by the buffer 56 to the output terminal 63. The signal block S_{j+1} is present and waits at the output of the buffer 57. At the instant that

the signal block S_n appears at the output of the buffer 56, the detector 75 detects the presence of the flag signal stored in that signal block. In response to the detection of the flag signal, a detection signal is supplied by the detector 75 to the generator 78. In response thereto, the generator 78 generates a second switching control signal, under the influence of which the switch 58 switches to the position c-a. The signal blocks S_{j+1} to S_{n-1} are now supplied to the output terminal 63 by the buffer 57. The signal block S_n is present and waits at the output of the buffer 56. The signal block which will occur at the output of the buffer 57 after having supplied the signal block S_{n-1} , will include a flag signal. Upon the detection of this flag signal by the detector 76, a first switching control signal is supplied by the generator 78 so that the switch 58 switches into the b-a position. The supply of signal blocks by the buffer 56 is now resumed, resulting in a reconstruction of the original sequence of the signal blocks.

[0066] In a modification, the flag signals are stored in the signal blocks S_j , S_{j+1} , S_m , ..., S_{n-1} , This results in the switching signal to be generated one signal block later in time.

[0067] When a flag signal is only used to indicate the moment of switching of the switch 58, it may be possible that when starting reproduction, the switch is in the wrong position. This can be detected in the (MPEG) decoder (not shown) that is coupled to the output terminal 63. Upon such detection by the decoder, an additional switching signal can be generated, so that the switch is switched to its correct switching phase.

[0068] It should be noted here, that the detection of the sequence number information or the flag signal information need not necessarily take place after the buffers 56 and 57. It may be possible to detect the sequence number information or the flag signal information earlier in the signal paths, where such detection is possible.

[0069] Figure 11 shows another embodiment of the reproducing arrangement, for reproducing information from a first track T_1 , a second track T_2 and a third track T_3 on the record carrier 10'. This record carrier 10' has been obtained by the recording arrangement of figure 6. Read heads 50, 51 and 80 are present for reading information from the first, second and third track T_1 , T_2 and T_3 respectively of the record carrier 10'. Outputs of the read heads 50, 51 and 80 are coupled to inputs of buffers 56, 57 and 84 respectively, via channel decoding circuitry (not shown). Outputs of the buffers 56, 57 and 84 are coupled to a terminal b, c and d respectively of a switch 58'. The buffers may be in the form of a FIFO. Further, a detector 60" is present having inputs 65, 66 and 86 coupled to the outputs of the buffers 56, 57 and 84 respectively.

[0070] Signal blocks are read from the tracks T_1 , T_2 and T_3 by the heads 50, 51 and 80, and are supplied to the buffers 56, 57 and 84 respectively and stored therein.

[0071] In one embodiment of the detector 60", shown

in figure 12, the detector detects the sequence numbers that are stored in each of the signal blocks. The detector of figure 12 comprises sequence number extractors 70, 71 and 88 having inputs coupled to the inputs 65, 66 and 86 respectively of the detector 60". Outputs of the extractors 70, 71 and 88 are coupled to respective inputs of a comparator 72', an output of which is coupled to the output of the detector 60". The comparator 72' compares the sequence numbers extracted from the signal blocks obtained from the buffer 56 with the sequence numbers extracted from the signal blocks obtained from the buffer 57 and with the sequence numbers extracted from the signal blocks obtained from the buffer 84. If the sequence number of a signal block present at the output of the buffer 56 is smaller than the sequence numbers of the signal blocks present at the output of the buffers 57 and 84, the comparator 72' generates a first switching control signal, which results in the switch 58' being positioned in the position b-a. This is the case when (replicas of) the signal blocks S_1 to S_j , see figure 2b, are supplied by the buffer 56, (the replica of) the signal block S_{j+1} is present (and waits) at the output of the buffer 84, and (the replica of) the signal block S_1 is present (and waits) at the output of the buffer 57.

[0072] As it is assumed that reproduction starts with the reproduction of signal blocks having I-frame information, the switch 58 is thus initially positioned in the position b-a.

[0073] First signal blocks are continuously supplied to the output of the buffer 56 and supplied to the output terminal 63, until the signal block S_j is supplied to the output. The next signal block at the output of buffer 56 is the signal block S_n , see figure 2b. The comparator 72' now detects that the sequence number of the signal block S_n supplied by the extractor 70 is larger than the sequence numbers of the signal block S_{j+1} present and waiting at the output of the buffer 84 and the signal block S_1 which is present and waiting at the output of the buffer 57. More specifically, the detector 60" detects the sequence number of the signal block S_{j+1} present and waiting at the output of the buffer 84 to be the smallest. As a result, the comparator 72' generates a third switching signal at its output. Under the influence of this signal, the switch 58' is switched to the d-a position. The outputting of signal blocks from the buffer 56 is now stopped and the buffer 84 now outputs signal blocks which signal blocks are applied to the output terminal 63. After having output the signal block S_{j+1} , see figure 2b, the comparator detects that the sequence number of the signal block S_1 present and waiting at the output of the buffer 57 is smaller than the sequence number of the signal block present at that instant (probably, this is the signal block S_{m+1}) at the output of the buffer 84 and smaller than the sequence number of the signal block present at that instant (probably, this is the signal block S_n at the output of the buffer 56). As a result, the second switching signal is generated and the switch 58' is switched to the c-a position. Now, the outputting of signal blocks from the

buffer 84 is stopped and the signal blocks S_1 to S_m are applied to the output terminal 63 by the buffer 57. In this way, the original sequence of the signal blocks is reconstructed.

[0074] The above described embodiment of the detector 60" also functions properly for the modified version in which, during recording, see figure 3, the sequence of signal blocks that are applied to one of the tracks between two switchings over of the switch 2, receive the same sequence number, and for the other modified version in which during recording, only the signal blocks directly following the switching over of the switch 2 to the other position receive a sequence number.

[0075] Another embodiment of the detector 60" is shown in figure 13. The detector in figure 13, denoted by 60'" comprises flag signal detectors 75, 76 and 90 having inputs coupled to the inputs 65, 66 and 86 respectively of the detector 60"". Outputs of the detectors 75', 76' and 90 are coupled to corresponding inputs of a switching control signal generator 78'.

[0076] During reproducing the first signal blocks S_i to S_j , see figure 2b, the switch 58' is in the position b-a and the signal blocks are supplied by the buffer 56 to the output terminal 63. The signal block S_{j+1} is present and waits at the output of the buffer 84 and the signal block S_i is present and waits at the output of the buffer 57. At the instant that the signal block S_j appears at the output of the buffer 56, the detector 75' detects the presence of the third flag signal stored in that signal block. In response to the detection of the third flag signal, a detection signal is supplied by the detector 75' to the generator 78'. In response thereto, the generator 78' generates a third switching control signal, under the influence of which the switch 58' switches to the position d-a. The signal blocks S_{j+1} to S_{l-1} are now supplied to the output terminal 63 by the buffer 84. The signal block S_n is present and waits at the output of the buffer 56 and the signal block S_i is still present and waits at the output of the buffer 57. The detector 90 will detect the second flag signal which is stored in the signal block S_{l-1} , as soon as that signal block S_{l-1} occurs at the output of the buffer 84. Upon the detection of this second flag signal by the detector 90, a second switching control signal is supplied by the generator 78' so that the switch 58' switches into the c-a position. The supply of signal blocks by the buffer 57 is now started, resulting in the supply of the signal blocks S_i to S_m to the output terminal 63. Next, the detector 76' will detect the third flag signal which is stored in the signal block S_{m-1} , as soon as that signal block S_{m-1} occurs at the output of the buffer 57. Upon the detection of this third flag signal by the detector 76', a third switching control signal is supplied by the generator 78' so that the switch 58' switches into the d-a position. The supply of signal blocks by the buffer 84 is now started. As soon as the signal block S_{n-1} is supplied by one of the buffers, the corresponding detector will detect the first flag signal stored in said signal block. Upon

the detection of this first flag signal, a first switching control signal is supplied by the generator 78' so that the switch 58' switches into the b-a position. The supply of signal blocks by the buffer 56 is now started. This results in a reconstruction of the original sequence of the signal blocks.

[0077] It should be noted here, that the detection of the sequence number information or the flag signal information need not necessarily take place after the buffers 56', 57' and 84. It may be possible to detect the sequence number information or the flag signal information earlier in the signal paths, where such detection is possible.

[0078] It will be evident that, in order to reproduce information from a record carrier as described with reference to figure 7, an appropriate number of additional reading heads are needed and other signal combining electronics are needed, in order to combine signals read from the various tracks.

[0079] Next, the reproduction of a data reduced video signal during a feature mode will be explained with reference to figure 14. Figure 14 shows the embodiment of figure 8 with additional elements that enable the reproduction in a feature mode, more specifically in a reproduction mode in which the speed of the record carrier is e.g. twice the nominal speed. The arrangement further comprises a controllable switch 100 having a terminal a coupled to the head 50 and a terminal b coupled to the head 51. A terminal c of the switch 100 is coupled to an input of channel decoding circuit 102. An output of the channel decoding circuit 102 is coupled to a terminal a of a controllable switch 110. A terminal b of the switch 110 is coupled to the input of the buffer 56 and a terminal c of the said switch is coupled to the input of the buffer 57. The channel decoding circuit 102 realizes in the normal play reproduction mode an equalization, a channel demodulation and an error correction separately on each of the two signals read from the tracks by means of the heads 50 and 51. To that purpose, the circuit 102 receives a clock signal from a central processing unit CPU via a line 108.

[0080] The position of the switches 100 and 110 is controlled by a control signal supplied via the line 112 to the switches. The detector 60 of figure 8 is also present, but is denoted by reference number 106 and has an additional control signal input 104. The central processing unit CPU also supplies a control signal to the detector 106.

[0081] When activating a 'normal play' reproduction mode by applying a control signal to the input 118 of the CPU, such control signals are applied to the switches 100 and 110 and to the detector 106, that the switch 100 periodically switches between the positions a-c and b-c with a frequency dictated by the control signal applied to the switch 100 via the line 112. In the same way, the switch 110 switches periodically between the positions a-b and a-c under the influence of that same control signal.

[0082] The switching is such that information read by the head 50 is processed in the circuit 102 and supplied to the buffer 56 and information read by the head 51 is processed by the circuit 102 and supplied to the buffer 57. The circuit 102 including the switches 100 and 110 thus acts as if separate channel decoding circuits would have been present for channel decoding the signals read by the two heads.

[0083] When activating a 'feature play' mode, by applying a control signal to the input 120 of the CPU, such control signal is applied to the switches 100 and 110 that they are in the positions a-c and a-b respectively. The record carrier transport speed may now be twice the nominal record carrier transport speed. The information recorded in the track T_1 is now read out with a data rate which is twice as high. The circuit 102 now carries out a channel decoding on the signal coming from the one track T_1 with the increased data rate. As a result, the channel decoder circuit 102 can function at its nominal processing speed, although the signal read out from the track has an increased data rate.

[0084] The control signal applied by the CPU to the control input 104 of the detector 106 disables the detector 106. In response to this control signal, the detector 106 now generates a switching control signal at its output 61 such that the switch 58 is continuously positioned in the position b-a.

[0085] As a result, at the output terminal 63, the data stream shown in figure 15 may be obtained. Assuming that the total I-frame information included in the original MPEG data stream is at most equal to half the total information content of the MPEG data stream, this means that all the signal blocks comprising I-frame information will be recorded in the track T_1 . May be, also some P- or B-frame information is also recorded in the track T_1 , namely in the case that the total I-frame information is less than the total information content of the MPEG data stream.

[0086] Figure 15 shows how the first signal blocks S_i to S_j are supplied to the output 63 of the arrangement of figure 14. These signal blocks comprise the I-frame information included in the frame F_2 , see figure 2a and 2b. If no other signal blocks than first signal blocks are stored in the track T_1 , this means that after having supplied the signal block S_j to the output 63, the next signal block supplied to the output 63 will be the signal block S_n , which is followed by the signal blocks S_{n+1} to S_p . These signal blocks comprise the I-frame information included in the frame F_{11} , see figure 2b.

[0087] It may be possible that second signal blocks have been stored in the track T_1 in between the signal blocks S_j and S_n , namely in the situation where the information content in the I-frames is less than half the total information content of the MPEG data stream. In the further signal processing carried out on the signal read out, only the I-frame information will be used to regenerate a replica of the digital video signal. An MPEG decoder (not shown) coupled to the output 63 will thus re-

alize a processing on the I-frame information which is inverse to the intra-picture encoding step carried out prior to recording, which results in a regenerated I-picture. The second signal blocks that may thus be present in the signal read by the head 50 will thus not be used in the decoder coupled to the output 63. Those second signal blocks, present in the output signal of figure 15, which output signal is thus available at the output of the processor circuit 102, can thus be left out. This can be realized in various ways. In one way, the switch 110 is switched in the position a-c as soon as second signal block information is supplied by the decoder circuit 102, so that no second signal block information is stored in the buffer 56. In another embodiment, the switch 58 has an additional position in which the terminal a is coupled to an open terminal. The switch 58 is switched to said open terminal when the buffer 56 supplies second signal block information to its output, so that no second signal block information is supplied to the MPEG decoder coupled to the output 63. In another embodiment, the MPEG decoder itself ignores the second signal block information that is supplied to its input.

[0088] As can be seen from figure 15, always complete I-frames are present in the reproduced output signal, such as the frames F_2 and F_{11} . Those reproduced I-frames can be decoded separately in an MPEG decoder so as to obtain the pictures a_2 and a_{11} , see figure 1. Those pictures can be stored in a picture memory (not shown) so as to enable a subsequent display of the pictures on a screen.

[0089] Next, the reproduction of a data reduced video signal during a feature mode of the reproducing arrangement of figure 11 will be explained. Figure 16 shows the embodiment of figure 11 with additional elements that enable the reproduction in a feature mode, more specifically in a reproduction mode in which the speed of the record carrier is e.g. thrice the nominal speed. The arrangement further comprises a controllable switch 100' having terminals a, b and d coupled to the heads 50, 51 and 80 respectively and a terminal c coupled to an input of channel decoding circuit 102'. An output of channel decoding circuit 102' is coupled to a terminal a of a controllable switch 110'. Terminals b, c and d of the switch 110' are coupled to the inputs of the buffers 56, 57 and 84 respectively. The channel decoding circuit 102' realizes in the normal play reproduction mode an equalization, a channel demodulation and an error correction separately on each of the three signals read from the tracks by means of the heads 50, 51 and 80. To that purpose, the circuit 102' receives a clock signal from a central processing unit CPU via a line 108.

[0090] The position of the switches 100' and 110' is controlled by a control signal supplied via the line 112 to the switches. The detector 60' of figure 11 is also present, but is denoted by reference number 106' and has an additional control signal input 104. The central processing unit CPU also supplies a control signal to the detector 106'.

[0091] When activating a 'normal play' reproduction mode by applying a control signal to the input 118 of the CPU, such control signals are applied to the switches 100' and 110' and to the detector 106', that the switch 100' periodically switches between the positions a-c, b-c and d-c with a frequency dictated by the control signal applied to the switch 100' via the line 112. In the same way, the switch 110' switches periodically between the positions a-b, a-c and a-d under the influence of that same control signal.

[0092] The switching is such that information read by the head 50 is processed in the circuit 102' and supplied to the buffer 56, information read by the head 51 is processed by the circuit 102' and supplied to the buffer 57 and information read by the head 80 is processed by the circuit 102' and supplied to the buffer 84. The circuit 102' including the switches 100' and 110' thus act as if separate channel decoding circuits would have been present for channel decoding the signals read by the three heads.

[0093] When activating a 'feature play' mode, by applying a control signal to the input 120 of the CPU, such control signal is applied to the switches 100' and 110' that they are in the positions a-c and a-b respectively. The record carrier transport speed may now be thrice the nominal record carrier transport speed. The information recorded in the track T_1 is now read out with a datarate which is thrice as high. The circuit 102' now carries out a channel decoding on the signal coming from the one track T_1 with the increased datarate. As a result, the channel decoder circuit 102' can function at its nominal processing speed, although the signal read out from the track has an increased datarate.

[0094] The control signal applied by the CPU to the control input 104 of the detector 106' disables the detector 106'. In response to this control signal, the detector 106' now generates a switching control signal at its output 61 such that the switch 58' is continuously positioned in the position b-a.

[0095] As a result, at the output terminal 63, again the datastream shown in figure 15 may be obtained. This with the assumption that the total I-frame information included in the original MPEG datastream is at most equal to one third of the total information content of the MPEG datastream. This means that all the signal blocks comprising I-frame information will be recorded in the track T_1 . May be, also some P- or B-frame information is also recorded in the track T_1 , namely in the case that the total I-frame information is less than the total information content of the MPEG datastream.

[0096] In the case that the total I-frame information content is larger than one third of the total MPEG information, I-frame information has also been recorded in the track T_2 or T_3 . Those I-frame information will thus not be read out and will thus be skipped during reproduction in the feature mode.

[0097] Although the embodiments of figure 14 and 16 have been described in a feature mode where the record

carrier speed is twice and thrice the nominal record carrier speed respectively, it is also possible to realize a feature mode with a record carrier speed larger than twice or thrice the record carrier speed, even without increasing the processing speed in the channel decoders. This will be explained hereafter.

[0098] Figure 17 shows a memory 140 of such a size that it is capable of storing an I-frame of maximum length. During reproduction in a feature mode with a record carrier speed much higher than two or three times the nominal speed, the signal read from a track by the head 142 is sampled and A/D converted in an A/D converter 146 with a sampling rate f_s which is equal to $N.f_n$, where f_n is the nominal sampling rate by when the apparatus is in the normal play mode. N is equal to the ratio between the 'trick play' reproduction speed and the nominal reproduction speed. Next the sampled and A/D converted signal is stored in the memory 140 under the influence of an write address signal applied to an address signal input 144 of the memory 140. The write addresses are generated by an address generator 148, having its address signal output coupled to the input 144 of the memory 140. The sampling frequency f_s equals the clock rate supplied to the generator 148, and is supplied by a clock signal generator 150. The address generator 148 generates addresses starting from a first address value corresponding to the address of the first address location in the memory 140, and subsequent address values up to the highest address value corresponding to the address of the last address location in the memory 140. Further a read address signal generator 149 is present supplying read address signals under the influence of the clock frequency f_n supplied by the generator 150. These read addresses are supplied to an address input 145 of the memory 140. Samples are thus stored in the memory 140 with a high bitrate and read out from the memory with a nominal bitrate. The circuit following the memory 140 can thus process the signals at its nominal clock frequency f_n .

[0099] The circuit following the memory 140 comprises a circuit 142 which realizes an equalization and bit detection on the signals supplied by the memory 140 and a signal processing circuit 175, which is adapted to process information comprised in an I-frame, so as to obtain a picture.

[0100] Further, a sync detector 152 is present capable of detecting a sync signal that is present in each I-frame. More specifically, the I-, P- and B frames may have the same sync signal. In that case, each frame comprises an identifier, identifying the frame as either an I-frame, or a P-frame or a B-frame. The detector 152 is then also capable of detecting the I-frame identifier.

[0101] An input of the detector 152 is coupled to the output of the circuit 142 and an output of the detector 152 is coupled to a control signal input 154 of a central processing unit CPU.

[0102] Further a comparator 156 is present having inputs 150 and 160 coupled to outputs of the address sig-

nal generators 148 and 149 respectively. An output 162 of the comparator 156 is coupled to an input of a central processing unit CPU. A control signal output 166 of the CPU is coupled to control signal inputs 168 and 169 of the address signal generators 148 and 149 respectively.

[0103] The functioning of the embodiment of figure 17 will be further explained with reference to the flow diagram in figure 18.

[0104] The reproduction in the feature mode starts in block 180. Next the start addresses of the address generators 148 and 149 are set to a start address value, which is in the present example equal to zero, see block 182. Samples of the reproduced signal arrive at the input of the memory 140 and are stored in the memory under the influence of the write addresses supplied to the input 144 with the frequency f_s . Samples stored in the memory 140 are read out in the meantime under the influence of read addresses supplied to the input 145 with the lower frequency f_n . This is realized in the block 186 in the flow diagram of figure 18. The samples read out at the nominal frequency are processed in the circuit 142. The processing circuit 175 is disabled at this moment under the influence of the control signal supplied by the CPU over the line 176.

[0105] The comparator 156 compares the difference between the instantaneous read and write addresses with a threshold value T_a . The difference between the instantaneous read and write address is a measure for the filling degree of the memory 140. If the filling degree of the memory 140 is too high, whilst no I-sync has been detected yet, this means that the processing circuits 142 and 175 will not be capable of detecting and fully processing an I-frame using the information content stored in the memory 140. The comparison by the comparator 156 is realized in block 192 in figure 18. If the result of the comparison in block 192 is confirmative, the program returns to block 182 via the line 194. The read and write address are reset and the program restarts. It may however be possible to restart the program by making the read address equal to the present write address and resume the program in block 186.

[0106] If the comparison in block 192 is affirmative, the program continues to block 196. If no sync signal is detected by the detector 152, the program continues via the line 190.

[0107] Upon detection of a sync signal by the sync detector 152, see the block 196, a detection signal is supplied by the detector 152 to the CPU. Upon the receipt of the detection signal, the CPU enables the processor circuit 175 by means of an enable signal via the line 176. Samples belonging to the I-frame, of which the I-sync was detected by the detector 152 are now stored in a memory (not shown) in the processor 175 and the processor circuit 175 starts processing the information content of the I-frame which is still partly stored in the memory 140 and which is supplied to the circuit 175.

[0108] The storage of samples in the memory 140 can be continued as long as the filling degree of the memory

140 is not 100 %, see block 184 and the line 190, so that it may be possible to detect a second I-sync. If the filling degree reaches the 100 % value, the storing of samples in the memory 140 is terminated, see block 188.

[0109] In block 200 it is determined when the I-frame has been received completely by the circuit 175. If so, the program returns to block 182. The storage of information in the memory 140 is now resumed, starting from the first address value, as indicated above.

[0110] If, however, the read address value has been made equal to the current write address value in the signal path 202, the storage of information is continued starting from the current write address of the generator 148.

[0111] The clock frequency for supplying the read addresses by the generator 149 for the read-out of samples from the memory 140, will be lower than the clock frequency for supplying the write addresses to the memory 140, for the read-in of samples. In this way, the higher datarate of the incoming data, supplied by the head 142, can be adapted to the lower clock frequency of the processing circuits 142 and 175.

List of references

[0112]

(D1) USP 4,807,053 (PHN 11.768)

(D2) Grand Alliance HDTV System Specification, draft document.

Submitted to the ACATS Technical Subgroup, February 22, 1994. Chapter III Video compression system.

Claims

1. Method of recording a data reduced digital video signal in tracks on a longitudinal record carrier, the recording method comprises the steps of

- receiving the data reduced digital video signal,
- writing the data reduced digital video signal in said tracks,

the data reduced digital video signal comprising first signal blocks having data reduced video information obtained from video information of a picture that has been subjected to an intra-picture encoding step, and comprising second signal blocks having data reduced video information obtained from video information of a picture that has been subjected to an inter-picture encoding step,

characterized in that, the recording method further comprises the steps of - recording the data reduced video signal in tracks running in the longitudinal direction of the record carrier,

- generating additional information having a relation to the sequence of the signal blocks in the data reduced video signal and supplying said additional information to at least some of said first and second signal blocks, 5
 - supplying first signal blocks to first writing means for writing in at least one first track,
 - supplying second signal blocks to second writing means for writing in at least one second track, and 10
 - supplying second signal blocks to said first writing means for writing in said at least one first track if a received amount of second signal blocks exceeds a maximum value or if a received amount of first signal blocks drops below a minimum value, or supplying first signal blocks to said second writing means for writing in said at least one second track if a received amount of first signal blocks exceeds a maximum value or if a received amount of second signal blocks drops below a minimum value. 15 20
2. Method as claimed in claim 1, the second signal blocks having data reduced video information obtained from video information of a picture that has been subjected to a uni-directional inter-picture encoding step, **characterized in that** the data reduced video signal further comprises third signal blocks having data reduced video information obtained from video information of a picture that has been subjected to a bi-directional inter-picture encoding step, the method further comprising the steps of 25 30
- supplying the third signal blocks to said writing means, and 35
 - writing said third signal blocks in a track on the record carrier.
3. Method as claimed in claim 2, **characterized in that** the method further comprises the steps of 40
- supplying third signal blocks to said second writing means, and
 - writing said third signal blocks in said at least one second track. 45
4. Method as claimed in claim 3, **characterized in that** the method further comprises the steps of 50
- supplying third signal blocks to said first writing means,
 - writing said third signal blocks in said at least one first track. 55
5. Method as claimed in claim 2, **characterized in that** the method further comprises the steps of
- supplying said additional information to at least some of said third signal blocks,
 - supplying third signal blocks to third writing means for writing in at least one third track running in the longitudinal direction of the record carrier,
 - supplying first signal blocks to said second or third writing means for writing in said at least one second or third track respectively, or supplying second signal blocks to said first or third writing means for writing in said at least one first or third track respectively, or supplying third signal blocks to said first or second writing means for writing in said at least one first or second track respectively.
6. Method as claimed in claim 1, **characterized in that** the data reduced video signal is a video signal of the MPEG type, the first signal blocks in the data reduced digital video signal comprising intra picture encoded video information of the I type.
7. Method as claimed in claim 2, **characterized in that** the data reduced video signal is a video signal of the MPEG type, the first signal blocks in the data reduced digital video signal comprising intra picture encoded video information of the I type, the second signal blocks in the data reduced digital video signal comprising inter picture encoded video information of the P type and the third signal blocks in the data reduced digital video signal comprising bi-directionally inter-picture encoded information of the B type.
8. Recording arrangement for recording a data reduced digital video signal in tracks on a longitudinal record carrier (10), the recording arrangement comprising
- an input terminal (1) for receiving the data reduced digital video signal,
 - writing means (18, 16) for writing the data reduced digital video signal in said tracks,
- the data reduced digital video signal comprising first signal blocks (I) having data reduced video information obtained from video information of a picture that has been subjected to an intra-picture encoding step, and comprising second signal blocks (P) having data reduced video information obtained from video information of a picture that has been subjected to an inter-picture encoding step, **characterized in that**, the recording arrangement is a recording arrangement of the linear recording type, the writing means comprising first writing means (6, 8) for writing information in at least one first track running (T_1) in the longitudinal direction of the record carrier and second writing means for writing (14, 16) information in at least one second

track (T_2) running in the longitudinal direction on the record carrier, additional information generator means (25) being present for generating additional information having a relation to the sequence of the signal blocks in the data reduced video signal, combining means (31) being present for supplying said additional information to at least some of said first and second signal blocks, multiplexer means (2, 18) adapted to supply first signal blocks to said first writing means for writing in said at least one first track, and also adapted to supply second signal blocks to said second writing means for writing in said at least one second track, the multiplexer means further being adapted to supply first signal blocks to said second writing means for writing in said at least one second track if a received amount of first signal blocks exceeds a maximum value or if a received amount of second signal blocks drops below a minimum value, or to supply second signal blocks to said first writing means for writing in said at least one first track if a received amount of second signal blocks exceeds a maximum value or if a received amount of first signal blocks drops below a minimum value.

9. Recording arrangement as claimed in claim 8, **characterized in that** the data reduced video signal further comprises third signal blocks (B) having data reduced video information obtained from video information of a picture that has been subjected to a bi-directional inter-picture encoding step, the multiplexer means (2, 18) being further adapted to supply third signal blocks to said writing means, and the writing means further being adapted to write said third signal blocks in a track on the record carrier.

10. Recording arrangement as claimed in claim 9, **characterized in that** the multiplexer means (2, 18) are also adapted to supply third signal blocks to said second writing means (14, 16) for writing in said at least one second track.

11. Recording arrangement as claimed in claim 10, **characterized in that** the multiplexer means (2, 18) are further adapted to supply third signal blocks to said first writing means for writing in said at least one first track.

12. Recording arrangement as claimed in claim 9, **characterized in that** the combining means (31) further being adapted to supply said additional information to at least some of said third signal blocks, the writing means further comprising third writing means (43, 45) for writing information in at least one third track (T_3) running in the longitudinal direction of the record carrier, the multiplexer means (2', 18'') being further adapted to supply third signal blocks to said third writing means for writing in said at least one third track, the multiplexer means further being

adapted to supply first signal blocks to said second or third writing means for writing in said at least one second or third track respectively, or to supply second signal blocks to said first or third writing means for writing in said at least one first or third track respectively, or to supply third signal blocks to said first or second writing means for writing in said at least one first or second track respectively.

13. Recording arrangement as claimed in claim 8, **characterized in that** the data reduced video signal is a video signal of the MPEG type, the first signal blocks in the video signal of the MPEG type comprising intra picture encoded video information of the I type.

14. Recording arrangement as claimed in claim 9, **characterized in that** the data reduced video signal is a video signal of the MPEG type, the first signal blocks in the video signal of the MPEG type comprising intra picture encoded video information of the I type, the second signal blocks in the video signal of the MPEG type comprising inter picture encoded video information of the P type and the third signal blocks comprising bi-directionally inter-picture encoded information of the B type.

15. Reproducing arrangement for reproducing a data reduced digital video signal recorded in tracks on a longitudinal record carrier (10), the reproducing arrangement comprising

- reading means (50, 51) for reading the data reduced digital video signal from said tracks,
- an output terminal (63) for supplying the data reduced digital video signal,

the data reduced digital video signal comprising first signal blocks (I) having data reduced video information obtained from video information of a picture that has been subjected to an intra-picture encoding step prior to recording, and comprising second signal blocks (P) having data reduced video information obtained from video information of a picture that has been subjected to an inter-picture encoding step prior to recording,

characterized in that, the reproducing arrangement is a reproducing arrangement of the linear reproducing type,

the reading means comprising first reading means (50, 56) for reading information recorded in at least one first track running in the longitudinal direction of the record carrier and second reading means (51, 57) for reading information recorded in at least one second track running in the longitudinal direction on the record carrier,

the first reading means being adapted to read first signal blocks and second signal blocks, if present,

from said at least one first track, the second reading means being adapted to read first signal blocks, if present, and second signal blocks from said at least one second track, detection means (60) being present for detecting additional information which has a relation to the sequence of the signal blocks in the data reduced video signal prior to recording, which additional information has been stored in at least some of said first and second signal blocks prior to recording, combination means (58) being present for combining in a 'normal play' reproduction mode, the first signal blocks and the second signal blocks in response to said detected additional information, so as to obtain a first replica of said data reduced digital video signal, and that in a 'trick play' reproduction mode, the combination means are further adapted to retrieve the first signal blocks read from said at least one first track only so as to obtain a second replica of said data reduced digital video signal.

16. Reproducing arrangement as claimed in claim 15, **characterized in that** the data reduced video signal further comprises third signal blocks (B) having data reduced video information obtained from video information of a picture that has been subjected to a bi-directional inter-picture encoding step, the reading means further being adapted to read third signal blocks from a track on the record carrier, the detection means further being adapted to detect said additional information which may be present in at least some of the third signal blocks, that in said 'normal play' reproduction mode the combining means (58) are further adapted to combine the first, second and third signal blocks in response to said detected additional signal, so as to obtain said first replica of said data reduced digital video signal.

17. Reproducing arrangement as claimed in claim 16, **characterized in that** the second reading means are further adapted to read third signal blocks from said at least one second track.

18. Reproducing arrangement as claimed in claim 17, **characterized in that** in that the first reading means (50, 56) are also adapted to read third signal blocks, if present, from said at least one first track (T_1).

19. Reproducing arrangement as claimed in claim 16, **characterized in that** the reading means further comprises third reading means (80, 84) for reading information recorded in at least one third track (T_3) running in the longitudinal direction of the record carrier, the first reading means being adapted to read first signal blocks, second signal blocks, if present, and

third signal blocks, if present, from said at least one first track, the second reading means being adapted to read first signal blocks, if present, second signal blocks and third signal blocks, if present, from said at least one second track, the third reading means being adapted to read first signal blocks, if present, second signal blocks, if present, and third signal blocks from said at least one third track.

20. Reproducing arrangement as claimed in claim 15, **characterized in that** the data reduced video signal is a video signal of the MPEG type, the first signal blocks in the video signal of the MPEG type comprising intra picture encoded video information of the I type.

21. Reproducing arrangement as claimed in claim 16, **characterized in that** the data reduced video signal is a video signal of the MPEG type, the first signal blocks in the video signal of the MPEG type comprising intra picture encoded video information of the I type, the second signal blocks in the video signal of the MPEG type comprising inter picture encoded video information of the P type and the third signal blocks comprising bi-directionally inter-picture encoded information of the B type.

22. Longitudinal record carrier (10) having a data reduced digital video signal recorded in tracks on the record carrier, the data reduced digital video signal comprising first signal blocks (I) having data reduced video information obtained from video information of a picture that has been subjected to an intra-picture encoding step, and comprising second signal blocks (P) having data reduced video information obtained from video information of a picture that has been subjected to an inter-picture encoding step, **characterized in that** the record carrier has at least one first track (T_1) and at least one second track (T_2) running in the longitudinal direction of the record carrier, first signal blocks being recorded in said at least one first track, second signal blocks being recorded in said at least one second track, none or further first signal blocks being recorded in said at least one second track, or none or further second signal blocks being recorded in said at least one first track, at least some of said first and second signal blocks comprising sequence number information for enabling reproduction of the video signal.

23. Reproducing arrangement as claimed in claim 15, for reproducing a data reduced digital video signal recorded in a track on a longitudinal record carrier in a feature mode with the record carrier speed being larger than nominal, **characterized in that**, the reading means comprises

- a reading head (142) for reading information

from the track,

- memory means (140) for storing information read from the track with a first rate and reading out said information with a second rate, said second rate being lower than said first rate, 5
- detection means (152) for detecting the start of a first signal block present in the signal read from the track,
- address generating means (148,149) for generating read-in addresses at said first rate, and for generating read-out addresses at said second rate, 10
- comparator means (156) for comparing a filling degree of the memory means with a threshold value (T_a), 15

that the reading means are adapted to carry out the following steps,

- (a) the address generating means are adapted to generate subsequent read-in addresses at said first rate and read-out addresses at said second rate, starting with a start address, for storing the information in and reading the information from subsequent storage locations in said memory means, 20
- (b) that upon the detection of the start of a first signal block present in the information read out from the memory by the detection means, an enable signal is generated so as to enable the decoding unit to start decoding the information corresponding to said first signal block, 25
- (c) that upon detection of the current filling degree being larger than or equal to said threshold value, the storage of information in said memory means is terminated, and that the reading means are adapted to return to 30
- (a) in response to termination of the decoding of said first signal block. 35

24. Reproducing arrangement as claimed in claim 23, **characterized in that**, the reading means are adapted to restart step (a) if during the step (a), the current filling degree reaches a second threshold value. 40
25. Reproducing arrangement as claimed in claim 23 or 24, **characterized in that** the data reduced video signal is a video signal of the MPEG type, the first signal blocks in the video signal of the MPEG type comprising intra picture encoded video information of the I type. 45

Patentansprüche

1. Verfahren zum Aufzeichnen eines datenreduzierten digitalen Videosignals in Spuren auf einem läng-

lichen Aufzeichnungsträger, wobei dieses Verfahren die nachfolgenden Verfahrensschritte umfasst:

- das Empfangen des datenreduzierten digitalen Videosignals,
- das Schreiben des datenreduzierten digitalen Videosignals in den genannten Spuren,

wobei das datenreduzierte digitale Videosignal erste Signalblöcke mit datenreduzierter Videoinformation aufweist, die erhalten worden ist aus Videoinformation eines Bildes, das einem Intra-Bildcodierungsschritt ausgesetzt worden ist, und zweite Signalblöcke mit datenreduzierter Videoinformation eines Bildes, das einem Interbildcodierungsschritt ausgesetzt worden ist,

dadurch gekennzeichnet, dass das Aufzeichnungsverfahren weiterhin die nachfolgenden Verfahrensschritte umfasst:

- das Aufzeichnen des datenreduzierten Videosignals in Spuren, die sich in der Längsrichtung des Aufzeichnungsträgers erstrecken,
- das Erzeugen zusätzlicher Information, die sich auf die Sequenz der Signalblöcke in dem datenreduzierten Videosignal bezieht und das Liefern der genannten zusätzlichen Information an wenigstens einigen der genannten ersten und zweiten Signalblöcke,
- das Liefern erster Signalblöcke zu ersten Schreibmitteln zum Einschreiben in wenigstens einer ersten Spur,
- das Liefern zweiter Signalblöcke zu zweiten Schreibmitteln zum Einschreiben in wenigstens einer zweiten Spur, und

das Liefern zweiter Blöcke zu den genannten ersten Schreibmitteln zum Einschreiben in der genannten wenigstens einen ersten Spur, wenn ein empfangener Betrag an zweiten Signalblöcken einen Maximalwert übersteigt, oder wenn ein empfangener Betrag an ersten Signalblöcken einen Mindestwert unterschreitet, oder zum Liefern erster Signalblöcke zu den genannten zweiten Schreibmitteln zum Einschreiben in der genannten wenigstens einen zweiten Spur, wenn ein empfangener Betrag an ersten Signalblöcken einen Maximalwert übersteigt, oder wenn ein empfangener Betrag an zweiten Signalblöcken einen Mindestwert unterschreitet.

2. Verfahren nach Anspruch 1, wobei die zweiten Signalblöcke datenreduzierte Videoinformation aufweisen, die aus Videoinformation eines Bildes erhalten worden ist, das einem Einrichtungs-Interbildcodierungsschritt ausgesetzt worden ist, **dadurch gekennzeichnet, dass** das datenreduzierte Videosignal weiterhin dritte Signalblöcke mit datenreduzierter Videoinformation umfasst, die aus Videoin-

formation eines Bildes erhalten worden ist, das einem Zweirichtungs-Interbildcodierungsschritt ausgesetzt worden ist, wobei das Verfahren weiterhin die nachfolgenden Verfahrensschritte umfasst:

- das Liefern der dritten Signalblöcke zu den genannten Schreibmitteln, und
- das Einschreiben der genannten dritten Signalblöcke in einer Spur auf dem Aufzeichnungsträger.

3. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** das Verfahren weiterhin die nachfolgenden Verfahrensschritte umfasst:

- das Liefern dritter Signalblöcke zu den genannten zweiten Schreibmitteln, und
- das Einschreiben der genannten dritten Signalblöcke in der genannten wenigstens einen zweiten Spur.

4. Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** das Verfahren weiterhin die nachfolgenden Verfahrensschritte umfasst:

- das Liefern dritter Signalblöcke zu den genannten ersten Schreibmitteln,
- das Einschreiben der genannten dritten Signalblöcke in der genannten wenigstens einen ersten Spur.

5. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** das Verfahren weiterhin die nachfolgenden Verfahrensschritte umfasst:

- das Liefern der genannten zusätzlichen Information zu wenigstens einigen der genannten dritten Signalblöcke,
- das Liefern dritter Signalblöcke zu dritten Schreibmitteln zum Einschreiben in wenigstens einer dritten Spur, die sich in der Längsrichtung des Aufzeichnungsträgers erstreckt,
- das Liefern erster Signalblöcke zu den genannten zweiten oder dritten Schreibmitteln zum Einschreiben in der genannten wenigstens einen zweiten oder dritten Spur, oder zum Liefern zweiter Signalblöcke zu den genannten ersten oder dritten Schreibmitteln zum Einschreiben in der genannten wenigstens einen ersten oder dritten Spur, oder zum Liefern dritter Signalblöcke zu den genannten ersten oder zweiten Schreibmitteln zum Einschreiben in der genannten wenigstens einen ersten oder zweiten Spur.

6. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** das datenreduzierte Videosignal ein Videosignal vom MPEG-Typ ist, wobei die er-

sten Signalblöcke in dem datenreduzierten digitalen Videosignal intrabildcodierte Videoinformation von dem I-Typ enthalten.

5 7. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** das datenreduzierte Videosignal ein Videosignal von dem MPEG-Typ ist, wobei die ersten Signalblöcke in dem datenreduzierten digitalen Videosignal intrabildcodierte Videoinformation von dem I-Typ enthalten, wobei die zweiten Signalblöcke in dem datenreduzierten digitalen Videosignal interbildcodierte Videoinformation von dem P-Typ enthalten und die dritten Signalblöcke in dem datenreduzierten digitalen Videosignal zweirichtungs-interbildcodierte Information vom B-Typ enthalten.

8. Aufzeichnungseinrichtung zum Aufzeichnen eines datenreduzierten digitalen Videosignals in Spuren auf einem länglichen Aufzeichnungsträger (10), wobei die Aufzeichnungseinrichtung die nachfolgenden Elemente umfasst:

- eine Eingangsklemme (1) zum Empfangen des datenreduzierten Videosignals,
- Schreibmittel (18, 16) zum Einschreiben des datenreduzierten digitalen Videosignals in den genannten Spuren, wobei das datenreduzierte digitale Videosignal erste Signalblöcke (I) mit datenreduzierter Videoinformation enthält, die aus Videoinformation eines Bildes erhalten worden ist, das einem Intrabildcodierungsschritt ausgesetzt worden ist, und zweite Signalblöcke (P) mit datenreduzierter Videoinformation enthält, die aus Videoinformation eines Bildes erhalten worden ist, das einem Interbildcodierungsschritt ausgesetzt worden ist,

dadurch gekennzeichnet, dass die Aufzeichnungseinrichtung eine Aufzeichnungseinrichtung von dem linearen Aufzeichnungstyp ist, wobei die Schreibmittel erste Schreibmittel (6, 8) aufweisen zum Einschreiben von Information in wenigstens einer ersten Spur (T_1), die sich in der Längsrichtung des Aufzeichnungsträgers erstreckt, und zweite Schreibmittel zum Einschreiben (14, 16) von Information in wenigstens einer zweiten Spur (T_2), die sich in der Längsrichtung des Aufzeichnungsträgers erstreckt, wobei es zusätzliche Informationserzeugungsmittel (25) gibt zum Erzeugen zusätzlicher Information mit einer Beziehung zu der Sequenz der Signalblöcke in dem datenreduzierten Videosignal, wobei es Kombiniermittel (31) gibt zum Liefern der genannten zusätzlichen Information zu wenigstens einigen der genannten ersten und zweiten Signalblöcke, Multiplexermittel (2, 18) zum Liefern erster Signalblöcke zu den genannten ersten Schreibmitteln zum Einschreiben in der genannten

wenigstens einen ersten Spur, und ebenfalls zum Liefern zweiter Signalblöcke zu den genannten zweiten Schreibmitteln zum Einschreiben in der genannten wenigstens einen zweiten Spur, wobei die Multiplexermittel weiterhin dazu vorgesehen sind, erste Signalblöcke zu den genannten zweiten Schreibmitteln zu liefern zum Einschreiben in der genannten wenigstens einen zweiten Spur, wenn ein empfangener Betrag an ersten Signalblöcken einen Maximalwert übersteigt, oder wenn ein empfangener Betrag an zweiten Signalblöcken einen Mindestwert unterschreitet, oder zum Liefern zweiter Signalblöcke zu den genannten ersten Schreibmitteln zum Einschreiben in der genannten wenigstens einen ersten Spur, wenn ein empfangener Betrag an zweiten Signalblöcken einen Maximalwert übersteigt, oder wenn ein empfangener Betrag an ersten Signalblöcken einen Mindestwert unterschreitet.

9. Aufzeichnungseinrichtung nach Anspruch 8, **dadurch gekennzeichnet, dass** das datenreduzierte Videosignal weiterhin dritte Signalblöcke (B) mit datenreduzierter Videoinformation enthält, erhalten aus Videoinformation eines Bildes, das einem Zweirichtungsinterbildcodierungsschritt ausgesetzt worden ist, wobei die Multiplexermittel (2, 18) weiterhin dritte Signalblöcke zu den genannten Schreibmitteln liefern, und wobei die Schreibmittel weiterhin die genannten dritten Signalblöcke in einer Spur auf dem Aufzeichnungsträger einschreiben.
10. Aufzeichnungseinrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** die Multiplexermittel (2, 18) ebenfalls dritte Signalblöcke zu den genannten zweiten Schreibmitteln (14, 16) liefern zum Einschreiben in der genannten wenigstens einen zweiten Spur.
11. Aufzeichnungseinrichtung nach Anspruch 10, **dadurch gekennzeichnet, dass** die Multiplexermittel (2, 18) weiterhin dritte Signalblöcke zu den genannten ersten Schreibmitteln liefern zum Einschreiben in der genannten wenigstens einen ersten Spur.
12. Aufzeichnungseinrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** die Kombiniermittel (31) weiterhin die genannte zusätzliche Information zu wenigstens einigen der genannten dritten Signalblöcke liefern, wobei die Schreibmittel weiterhin dritte Schreibmittel (43, 45) umfassen zum Einschreiben von Information in wenigstens einer dritten Spur (T_3), die sich in der Längsrichtung des Aufzeichnungsträgers erstreckt, wobei die Multiplexermittel (2', 18'') weiterhin dritte Signalblöcke zu den genannten dritten Schreibmitteln liefern zum Einschreiben in der genannten wenigstens einen dritten Spur, wobei die Multiplexermittel weiterhin erste

Signalblöcke zu den genannten zweiten oder dritten Schreibmitteln liefern zum Einschreiben in der genannten wenigstens einen zweiten oder dritten Spur, oder zum Liefern zweiter Signalblöcke zu den genannten ersten oder dritten Schreibmitteln zum Einschreiben in der genannten wenigstens einen ersten oder dritten Spur, oder zum Liefern dritter Signalblöcke zu den genannten ersten oder zweiten Schreibmitteln zum Einschreiben in der genannten wenigstens einen ersten oder zweiten Spur.

13. Aufzeichnungseinrichtung nach Anspruch 8, **dadurch gekennzeichnet, dass** das datenreduzierte Videosignal ein Videosignal von dem MPEG-Typ ist, wobei die ersten Signalblöcke in dem Videosignal von dem MPEG-Typ intrabildcodierte Videoinformation von dem I-Typ enthält.
14. Aufzeichnungseinrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** das datenreduzierte Videosignal ein Videosignal vom MPEG-Typ ist, wobei die ersten Signalblöcke in dem Videosignal vom MPEG-Typ intrabildcodierte Videoinformation von dem I-Typ enthalten, wobei die zweiten Signalblöcke in dem Videosignal von dem MPEG-Typ interbildcodierte Videoinformation von dem P-Typ enthalten und die dritten Signalblöcke zweirichtungsinterbildcodierte Information von dem B-Typ enthalten.
15. Wiedergabeeinrichtung zum Wiedergeben eines datenreduzierten Videosignals, das in Spuren auf einem länglichen Aufzeichnungsträger (10) aufgezeichnet ist, wobei die Wiedergabeeinrichtung die nachfolgenden Elemente umfasst:
 - Lesemittel (50, 51) zum Auslesen des datenreduzierten Videosignals aus den genannten Spuren,
 - eine Ausgangsklemme (63) zum Liefern des datenreduzierten digitalen Videosignals,

wobei das datenreduzierte Videosignal erste Signalblöcke (I) mit datenreduzierter Videoinformation enthält, die erhalten worden ist von Videoinformation eines Bildes, das vor der Aufzeichnung einem Intrabildcodierungsschritt ausgesetzt worden ist, und zweite Signalblöcke (P) mit datenreduzierter Videoinformation enthält, die erhalten worden ist von Videoinformation eines Bildes, das vor der Aufzeichnung einem Interbildcodierungsschritt ausgesetzt worden ist,

dadurch gekennzeichnet, dass die Wiedergabeeinrichtung eine Wiedergabeeinrichtung von dem linearen Wiedergabetyp ist, wobei die Auslesemittel erste Auslesemittel (50, 56) umfassen zum Auslesen von Information, die in wenigstens einer ersten Spur aufgezeichnet worden

ist, die sich in der Längsrichtung des Aufzeichnungsträgers erstreckt, und zweite Auslesemittel (51, 57) zum Auslesen von Information, die in wenigstens einer zweiten Spur aufgezeichnet worden ist, die sich in der Längsrichtung des Aufzeichnungsträgers erstreckt,

wobei die ersten Auslesemittel erste Signalblöcke und etwaige zweite Signalblöcke aus der genannten wenigstens einen ersten Spur auslesen, wobei die zweiten Auslesemittel etwaige erste Signalblöcke und zweite Signalblöcke aus der genannten wenigstens zweiten Spur auslesen,

wobei Detektionsmittel (60) vorhanden sind zum Detektieren zusätzlicher Information, die vor der Aufzeichnung eine Beziehung mit der Sequenz der Signalblöcke in dem datenreduzierten Videosignal hat, wobei diese zusätzliche Information vor der Aufzeichnung in wenigstens einigen der genannten ersten und zweiten Signalblöcke gespeichert worden ist,

wobei Kombiniermittel (58) vorgesehen sind zum in einer "Normalwiedergabe"-Betriebsart Kombinieren der ersten Signalblöcke mit den zweiten Signalblöcken in Reaktion auf die genannte detektierte zusätzliche Information, zum Erhalten einer ersten Replik des genannten datenreduzierten Videosignals, und dass in der "Trickwiedergabe"-Betriebsart die Kombiniermittel weiterhin die ersten Signalblöcke suchen, die aus der genannten wenigstens einen ersten Spur ausgelesen worden sind nur zum Erhalten einer zweiten Replik des genannten datenreduzierten Videosignals.

16. Wiedergabeeinrichtung nach Anspruch 15, **dadurch gekennzeichnet, dass** das datenreduzierte Videosignal weiterhin dritte Signalblöcke (B) mit datenreduzierter Videoinformation enthält, erhalten aus Videoinformation eines Bildes, das einem Zweirichtungsinterbildcodierungsschritt ausgesetzt worden ist

wobei die Lesemittel weiterhin dritte Signalblöcke aus einer Spur auf dem Aufzeichnungsträger auslesen,

wobei die Detektionsmittel weiterhin die genannte zusätzliche Information detektieren, die in wenigstens einigen der dritten Signalblöcken vorhanden sein kann, dass in der genannten "Normalwiedergabe"-Betriebsart die Kombiniermittel (58) weiterhin die ersten, zweiten und dritten Signalblöcke kombinieren, und zwar in Reaktion auf das genannte detektierte zusätzliche Signal, zum Erhalten der genannten ersten Replik des genannten datenreduzierten digitalen Videosignals.

17. Wiedergabeeinrichtung nach Anspruch 16, **dadurch gekennzeichnet, dass** die zweiten Lesemittel weiterhin dritte Signalblöcke aus der genannten wenigstens einen zweiten Spur auslesen.

18. Wiedergabeeinrichtung nach Anspruch 17, **dadurch gekennzeichnet, dass** die ersten Lesemittel (50, 56) aus der genannten wenigstens einen ersten Spur (T_1) ebenfalls etwaige dritte Signalblöcke auslesen.

19. Wiedergabeeinrichtung nach Anspruch 16, **dadurch gekennzeichnet, dass** die Lesemittel weiterhin dritte Auslesemittel (80, 84) umfassen zum Auslesen von Information, die in wenigstens einer Spur (T_3) aufgezeichnet worden ist, die sich in der Längsrichtung des Aufzeichnungsträgers erstreckt, wobei die ersten Lesemittel erste Signalblöcke, etwaige zweite Signalblöcke, und etwaige dritte Signalblöcke aus der genannten wenigstens einen ersten Spur auslesen, wobei die zweiten Lesemittel etwaige erste Signalblöcke, zweite Signalblöcke und etwaige dritte Signalblöcke aus der genannten wenigstens einen zweiten Spur auslesen, wobei die dritten Lesemittel etwaige erste Signalblöcke, etwaige zweite Signalblöcke und dritte Signalblöcke aus der genannten wenigstens einen dritten Spur auslesen.

20. Wiedergabeeinrichtung nach Anspruch 15, **dadurch gekennzeichnet, dass** das datenreduzierte Videosignal ein Videosignal von dem MPEG-Typ ist, wobei die ersten Signalblöcke in dem Videosignal von dem MPEG-Typ intrabildcodierte Videoinformation von dem I-Typ enthält.

21. Wiedergabeeinrichtung nach Anspruch 16, **dadurch gekennzeichnet, dass** das datenreduzierte Videosignal ein Videosignal von dem MPEG-Typ ist, wobei die ersten Signalblöcke in dem Videosignal von dem MPEG-Typ intrabildcodierte Videoinformation von dem I-Typ enthalten, wobei die zweiten Signalblöcke in dem Videosignal von dem MPEG-Typ interbildcodierte Videoinformation von dem P-Typ enthalten und die dritten Signalblöcke zweirichtungs-interbildcodierte Information von dem B-Typ enthalten.

22. Länglicher Aufzeichnungsträger (10) mit einem datenreduzierten digitalen Videosignal, aufgezeichnet in Spuren auf dem Aufzeichnungsträger, wobei das datenreduzierte digitale Videosignal erste Signalblöcke (I) mit datenreduzierter Videoinformation enthält, erhalten aus Videoinformation eines Bildes, das einem Intrabildcodierungsschritt ausgesetzt worden ist, und zweite Signalblöcke (P) mit datenreduzierter Videoinformation enthält, erhalten aus Videoinformation eines Bildes, das einem Interbildcodierungsschritt ausgesetzt worden ist, **dadurch gekennzeichnet, dass** der Aufzeichnungsträger wenigstens eine erste Spur (T_1) und wenigstens eine zweite Spur (T_2) umfasst, die sich in der Längsrichtung des Aufzeichnungsträgers erstreckt.

ken, wobei die ersten Signalblöcke in der genannten wenigstens einen ersten Spur aufgezeichnet werden, die zweiten Signalblöcke in der genannten wenigstens einen zweiten Spur aufgezeichnet werden, wobei keine weitere erste Signalblöcke in der genannten wenigstens einen zweiten Spur aufgezeichnet werden, oder keine oder weitere zweite Signalblöcke in der genannten wenigstens einen ersten Spur aufgezeichnet werden, wobei wenigstens einige der genannten ersten und zweiten Signalblöcke Sequenznummerinformation aufweisen zum Ermöglichen der Wiedergabe des Videosignals.

23. Wiedergabeeinrichtung nach Anspruch 15 zum Wiedergeben eines datenreduzierten digitalen Videosignals, aufgezeichnet in einer Spur auf einem Aufzeichnungsträger in einer Betriebsart, wobei die Geschwindigkeit des Aufzeichnungsträgers größer ist als die Nenngeschwindigkeit, **dadurch gekennzeichnet, dass** die Lesemittel die nachfolgenden Elemente umfassen:

- einen Lesekopf (142) zum Auslesen von Information aus der Spur,
- Speichermittel (140) zum Speichern von Information, die aus der Spur ausgelesen worden ist, mit einer ersten Rate und zum Auslesen der genannten Information mit einer zweiten Rate, wobei diese genannte zweite Rate niedriger ist als die genannte erste Rate,
- Detektionsmittel (152) zum Detektieren des Startes eines ersten Signalblocks in dem Signal, das aus der Spur ausgelesen worden ist,
- Adressenerzeugungsmittel (148, 149) zum Erzeugen von Einleseadressen mit der genannten ersten Rate und zum Erzeugen von Ausleseadressen mit der genannten zweiten Rate,
- Vergleichsmittel (156) zum Vergleichen eines Füllgrades der Speichermittel mit einem Schwellenwert (T_a),

dass die Lesemittel die nachfolgenden Verfahrensschritte durchführen:

- (a) die Adressenerzeugungsmittel erzeugen aufeinander folgende Einleseadressen mit der genannten ersten Rate und Ausleseadressen mit der genannten zweiten Rate, ausgehend von einer Startadresse, zum Speichern der Information an aufeinander folgenden Speicherstellen und zum Auslesen der Information aus diesen Speicherstellen in den genannten Speichermitteln,
- (b) dass bei Detektion des Startes eines ersten Signalblocks in der Information, die von den Detektionsmitteln aus dem Speicher ausgelesen worden ist, ein Freigabesignal erzeugt

wird, damit die Decodierungseinheit die Decodierung der Information starten kann, die dem genannten ersten Signalblock entspricht, (c) dass bei Detektion davon, dass der aktuelle Füllgrade größer ist als der genannte Schwellenwert oder diesem Schwellenwert entspricht, die Speicherung von Information in den genannten Speichermitteln beendet wird, und dass die Lesemittel zurückkehren,

(a) in Reaktion auf die Beendigung der Decodierung des genannten ersten Signalblocks.

24. Wiedergabeeinrichtung nach Anspruch 23, **dadurch gekennzeichnet, dass** die Lesemittel den Schritt (a) neu starten, wenn während des Schrittes (a) der aktuelle Füllgrad einen zweiten Schwellenwert erreicht.

25. Wiedergabeeinrichtung nach Anspruch 23 oder 24, **dadurch gekennzeichnet, dass** das datenreduzierte Videosignal ein Videosignal von dem MPEG-Typ ist, wobei die ersten Signalblöcke in dem Videosignal von dem MPEG-Typ intrabildcodierte Videoinformation von dem I-Typ enthalten.

Revendications

1. Procédé d'enregistrement d'un signal vidéo numérique réduit en données dans des pistes sur un support d'enregistrement longitudinal, le procédé d'enregistrement comprenant les étapes de :

- recevoir le signal vidéo numérique réduit en données, et
- écrire le signal vidéo numérique réduit en données dans lesdites pistes ;

le signal vidéo numérique réduit en données comprenant des premiers blocs de signal comportant une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage intra-image et comprenant des deuxièmes blocs de signal comportant une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage inter-image, **caractérisé en ce que** le procédé d'enregistrement comprend en outre les étapes de :

- enregistrer le signal vidéo réduit en données dans des pistes s'étendant dans le sens longitudinal du support d'enregistrement ;
- produire une information supplémentaire présentant un rapport avec la séquence des blocs de signal dans le signal vidéo réduit en données et fournir ladite information supplémentaire

- re à au moins certains desdits premiers et deuxièmes blocs de signal ;
- fournir des premiers blocs de signal à des premiers moyens d'écriture pour écrire dans au moins une première piste ;
 - fournir des deuxièmes blocs de signal à des deuxièmes moyens d'écriture pour écrire dans au moins une deuxième piste ;
 - fournir des deuxièmes blocs de signal auxdits premiers moyens d'écriture pour écrire dans ladite au moins une première piste si une quantité reçue de deuxièmes blocs de signal dépasse une valeur maximale ou si une quantité reçue de premiers blocs de signal tombe en dessous d'une valeur minimale, ou fournir des premiers blocs de signal auxdits deuxièmes moyens d'écriture pour écrire dans ladite au moins une deuxième piste si une quantité reçue de premiers blocs de signal dépasse une valeur maximale ou si une quantité reçue de deuxièmes blocs de signal tombe en dessous d'une valeur minimale.
2. Procédé suivant la revendication 1, les deuxièmes blocs de signal comportant une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage inter-image unidirectionnel, **caractérisé en ce que** le signal vidéo réduit en données comprend en outre des troisièmes blocs de signal comportant une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage inter-image bidirectionnel, le procédé comprenant en outre les étapes de :
- fournir les troisièmes blocs de signal auxdits moyens d'écriture, et
 - écrire lesdits troisièmes blocs de signal dans une piste sur le support d'enregistrement.
3. Procédé suivant la revendication 2, **caractérisé en ce que** le procédé comprend en outre les étapes de :
- fournir des troisièmes blocs de signal auxdits deuxièmes moyens d'écriture, et
 - écrire lesdits troisièmes blocs de signal dans au moins une deuxième piste.
4. Procédé suivant la revendication 3, **caractérisé en ce que** le procédé comprend en outre les étapes de :
- fournir des troisièmes blocs de signal auxdits premiers moyens d'écriture, et
 - écrire lesdits troisièmes blocs de signal dans au moins une première piste.
5. Procédé suivant la revendication 2, **caractérisé en ce que** le procédé comprend en outre les étapes de :
- fournir ladite information supplémentaire à au moins certains desdits troisièmes blocs de signal ;
 - fournir des troisièmes blocs de signal à des troisièmes moyens d'écriture pour écrire dans au moins une troisième piste s'étendant dans le sens longitudinal du support d'enregistrement, et
 - fournir des premiers blocs de signal auxdits deuxièmes ou troisièmes moyens d'écriture pour écrire respectivement dans ladite au moins une deuxième ou troisième piste, ou fournir des deuxièmes blocs de signal auxdits premiers ou troisièmes moyens d'écriture pour écrire respectivement dans ladite au moins une première ou troisième piste, ou fournir des troisièmes blocs de signal auxdits premiers ou deuxièmes moyens d'écriture pour écrire respectivement dans ladite au moins une première ou deuxième piste.
6. Procédé suivant la revendication 1, **caractérisé en ce que** le signal vidéo réduit en données est un signal vidéo du type MPEG, les premiers blocs de signal dans le signal vidéo numérique réduit en données comprenant une information vidéo à codage intra-image du type I.
7. Procédé suivant la revendication 2, **caractérisé en ce que** le signal vidéo réduit en données est un signal vidéo du type MPEG, les premiers blocs de signal dans le signal vidéo numérique réduit en données comprenant une information vidéo à codage intra-image du type I, les deuxièmes blocs de signal dans le signal vidéo numérique réduit en données comprenant une information vidéo à codage inter-image du type P et les troisièmes blocs de signal dans le signal vidéo numérique réduit en données comprenant une information à codage inter-image bidirectionnel du type B.
8. Montage d'enregistrement pour enregistrer un signal vidéo numérique réduit en données dans des pistes sur un support d'enregistrement longitudinal (10), le montage d'enregistrement comprenant :
- une borne d'entrée (1) pour recevoir le signal vidéo numérique réduit en données, et
 - des moyens d'écriture (18, 16) pour écrire le signal vidéo numérique réduit en données dans lesdites pistes ;
- le signal vidéo numérique réduit en données comprenant des premiers blocs de signal (I) comportant

une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage intra-image et comprenant des deuxièmes blocs de signal (P) comportant une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage inter-image,

caractérisé en ce que le montage d'enregistrement est un montage d'enregistrement du type à enregistrement linéaire, les moyens d'écriture comprenant des premiers moyens d'écriture (6, 8) pour écrire une information dans au moins une première piste (T_1) s'étendant dans le sens longitudinal du support d'enregistrement et des deuxièmes moyens d'écriture pour écrire (14, 16) une information dans au moins une deuxième piste (T_2) s'étendant dans le sens longitudinal sur le support d'enregistrement, des moyens de production d'information supplémentaire (25) étant présents pour produire une information supplémentaire présentant un rapport à la séquence des blocs de signal dans le signal vidéo réduit en données, des moyens de combinaison (31) étant présents pour fournir ladite information supplémentaire à au moins certains desdits premiers et deuxièmes blocs de signal, des moyens de multiplexage (2, 18) propres à fournir des premiers blocs de signal auxdits premiers moyens d'écriture pour écrire dans ladite au moins une première piste, et également propres à fournir des deuxièmes blocs de signal auxdits deuxièmes moyens d'écriture pour écrire dans ladite au moins une deuxième piste, les moyens de multiplexage étant en outre propres à fournir des premiers blocs de signal auxdits deuxièmes moyens d'écriture pour écrire dans ladite au moins une deuxième piste si une quantité reçue de premiers blocs de signal dépasse une valeur maximale ou si une quantité reçue de deuxièmes blocs de signal tombe en dessous d'une valeur minimale, ou fournir des deuxièmes blocs de signal auxdits premiers moyens d'écriture pour écrire dans ladite au moins une première piste si une quantité reçue de deuxièmes blocs de signal dépasse une valeur maximale ou si une quantité reçue de premiers blocs de signal tombe en dessous d'une valeur minimale.

9. Montage d'enregistrement suivant la revendication 8, **caractérisé en ce que** le signal vidéo réduit en données comprend en outre des troisièmes blocs de données (B) comportant une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage inter-image bidirectionnel, les moyens de multiplexage (2, 18) étant en outre propres à fournir des troisièmes blocs de signal auxdits moyens d'écriture, et les moyens d'écriture étant en outre propres à écrire lesdits troisièmes blocs de

signal dans une piste sur le support d'enregistrement.

10. Montage d'enregistrement suivant la revendication 9, **caractérisé en ce que** les moyens de multiplexage (2, 18) sont également propres à fournir des troisièmes blocs de signal auxdits deuxièmes moyens d'écriture (14, 16) pour écrire dans ladite au moins une deuxième piste.
11. Montage d'enregistrement suivant la revendication 10, **caractérisé en ce que** les moyens de multiplexage (2, 18) sont en outre propres à fournir des troisièmes blocs de signal auxdits premiers moyens d'écriture pour écrire dans ladite au moins une première piste.
12. Montage d'enregistrement suivant la revendication 9, **caractérisé en ce que** les moyens de combinaison (31) sont en outre propres à fournir ladite information supplémentaire à au moins certains desdits troisièmes blocs de signal, les moyens d'écriture comprenant en outre des troisièmes moyens d'écriture (43, 45) pour écrire une information dans au moins une troisième piste (T_3) s'étendant dans le sens longitudinal du support d'enregistrement, les moyens de multiplexage (2, 18) étant en outre propres à fournir des troisièmes blocs de signal auxdits troisièmes moyens d'écriture pour écrire dans ladite au moins une troisième piste. les moyens de multiplexage étant en outre propres à fournir des premiers blocs de signal auxdits deuxièmes ou troisièmes moyens d'écriture respectivement pour écrire dans ladite au moins une deuxième ou troisième piste, ou à fournir des deuxièmes blocs de signal auxdits premiers ou troisièmes moyens d'écriture respectivement pour écrire dans ladite au moins une première ou troisième piste, ou à fournir des troisièmes blocs de signal auxdits premiers ou deuxièmes moyens d'écriture respectivement pour écrire dans ladite au moins une première ou deuxième piste.
13. Montage d'enregistrement suivant la revendication 8, **caractérisé en ce que** le signal vidéo réduit en données est un signal vidéo du type MPEG, les premiers blocs de signal dans le signal vidéo du type MPEG comprenant une information vidéo à codage intra-image du type I.
14. Montage d'enregistrement suivant la revendication 9, **caractérisé en ce que** le signal vidéo réduit en données est un signal vidéo du type MPEG, les premiers blocs de signal dans le signal vidéo du type MPEG comprenant une information vidéo à codage intra-image du type I, les deuxièmes blocs de signal dans le signal vidéo du type MPEG comprenant une information vidéo à codage inter-image du type P

et les troisièmes blocs de signal comprenant une information à codage inter-image bidirectionnel du type B.

15. Montage de reproduction pour reproduire un signal vidéo numérique réduit en données enregistré dans des pistes sur un support d'enregistrement longitudinal (10), le montage de reproduction comprenant :

- des moyens de lecture (50, 51) pour extraire le signal vidéo numérique réduit en données desdites pistes, et
- une borne de sortie (63) pour fournir le signal vidéo numérique réduit en données,

le signal vidéo numérique réduit en données comprenant des premiers blocs de signal (I) comportant une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage intra-image avant enregistrement et comprenant des deuxièmes blocs de signal (P) comportant une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage inter-image avant enregistrement, **caractérisé en ce que** le montage de reproduction est un montage de reproduction du type à reproduction linéaire,

les moyens de lecture comprenant des premiers moyens de lecture (50, 56) pour lire une information enregistrée dans au moins une première piste s'étendant dans le sens longitudinal du support d'enregistrement et des deuxièmes moyens de lecture (51, 57) pour lire une information enregistrée dans au moins une deuxième piste s'étendant dans le sens longitudinal sur le support d'enregistrement, les premiers moyens de lecture étant propres à extraire des premiers blocs de signal et des deuxièmes blocs de signal, s'ils sont présents, de ladite au moins une première piste, les deuxièmes moyens de lecture étant propres à extraire des premiers blocs de signal, s'ils sont présents, et des deuxièmes blocs de signal de ladite au moins une deuxième piste,

des moyens de détection (60) étant présents pour détecter une information supplémentaire qui présente un rapport à la séquence des blocs de signal dans le signal vidéo réduit en données avant enregistrement, laquelle information supplémentaire a été stockée dans au moins une partie desdits premiers et deuxièmes blocs de signal avant enregistrement, des moyens de combinaison (58) étant présents pour combiner dans un mode de reproduction à "lecture normale", les premiers blocs de signal et les deuxièmes blocs de signal en réaction à ladite information supplémentaire détectée, de manière à obtenir une première réplique dudit signal

vidéo numérique réduit en données, et **en ce que** dans un mode de reproduction à "lecture truquée", les moyens de combinaison sont en outre propres à récupérer les premiers blocs de signal de ladite au moins une première piste uniquement de manière à obtenir une deuxième réplique dudit signal vidéo numérique réduit en données.

16. Montage de reproduction suivant la revendication 15, **caractérisé en ce que** le signal vidéo réduit en données comprend en outre des troisièmes blocs de signal (B) comportant une information vidéo réduite en données obtenue à partir d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage inter-image bidirectionnel, les moyens de lecture étant en outre propres à extraire des troisièmes blocs de signal d'une piste sur le support d'enregistrement, les moyens de détection étant en outre propres à détecter ladite information supplémentaire qui peut être présente dans au moins certains des troisièmes blocs de signal, **en ce que**, dans ledit mode de reproduction à "lecture normale", les moyens de combinaison (58) sont en outre propres à combiner les premiers, deuxièmes et troisièmes blocs de signal en réaction audit signal supplémentaire détecté, de manière à obtenir ladite première réplique dudit signal vidéo numérique réduit en données.

17. Montage de reproduction suivant la revendication 16, **caractérisé en ce que** les deuxièmes moyens de lecture sont en outre propres à extraire des troisièmes blocs de signal de ladite au moins une deuxième piste.

18. Montage de reproduction suivant la revendication 17, **caractérisé en ce que** les premiers moyens de lecture (50, 56) sont également propres à extraire des troisièmes blocs de signal, s'ils sont présents, de ladite au moins une première piste (T_1).

19. Montage de reproduction suivant la revendication 16, **caractérisé en ce que** les moyens de lecture comprennent en outre des troisièmes moyens de lecture (80, 84) pour lire une information enregistrée dans au moins une troisième piste (T_3) s'étendant dans le sens longitudinal du support d'enregistrement, les premiers moyens de lecture étant propres à extraire des premiers blocs de signal, des deuxièmes blocs de signal, s'ils sont présents, et des troisièmes blocs de signal, s'ils sont présents, de ladite au moins une première piste, les deuxièmes moyens de lecture étant propres à extraire des premiers blocs de signal, s'ils sont présents, des deuxièmes blocs de signal et des troisièmes blocs de signal, s'ils sont présents, de ladite au moins une deuxième piste, les troisièmes moyens de lecture

étant propres à extraire des premiers blocs de signal, s'ils sont présents, des deuxièmes blocs de signal, s'ils sont présents, et des troisièmes blocs de signal de ladite au moins une troisième piste.

20. Montage de reproduction suivant la revendication 15, **caractérisé en ce que** le signal vidéo réduit en données est un signal vidéo du type MPEG, les premiers blocs de signal dans le signal vidéo du type MPEG comprenant une information vidéo à codage intra-image du type I.

21. Montage de reproduction suivant la revendication 16, **caractérisé en ce que** le signal vidéo réduit en données est un signal vidéo du type MPEG, les premiers blocs de signal dans le signal vidéo du type MPEG comprenant une information vidéo à codage intra-image du type I, les deuxièmes blocs de signal dans le signal vidéo du type MPEG comprenant une information vidéo à codage inter-image du type P et les troisièmes blocs de signal comprenant une information à codage inter-image bidirectionnel du type B.

22. Support d'enregistrement longitudinal (10) comportant un signal vidéo numérique réduit en données enregistré dans des pistes sur le support d'enregistrement, le signal vidéo numérique réduit en données comprenant des premiers blocs de signal (I) comportant une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage intra-image et comprenant des deuxièmes blocs de signal (P) comportant une information vidéo réduite en données obtenue d'une information vidéo d'une image vidéo qui a été soumise à une étape de codage inter-image, **caractérisé en ce que** le support d'enregistrement comprend au moins une première piste (T_1) et au moins une deuxième piste (T_2) s'étendant dans le sens longitudinal du support d'enregistrement, des premiers blocs de signal étant enregistrés dans ladite au moins une première piste, des deuxièmes blocs de signal étant enregistrés dans ladite au moins une deuxième piste, aucun ou d'autres premiers blocs de signal étant enregistrés dans ladite au moins une deuxième piste, ou aucun ou d'autres deuxièmes blocs de signal étant enregistrés dans ladite au moins une première piste, au moins certains desdits premiers et deuxièmes blocs de signal comprenant une information de numéro de séquence pour permettre la reproduction du signal vidéo.

23. Montage de reproduction suivant la revendication 15, pour reproduire un signal vidéo numérique réduit en données enregistré dans une piste sur un support d'enregistrement longitudinal dans un mode caractéristique, la vitesse de support d'enregis-

trement étant supérieure à la vitesse nominale, **caractérisé en ce que** le moyen de lecture comprend :

- une tête de lecture (142) pour extraire une information de la piste ;
- des moyens de mémoire (140) pour stocker une information extraite de la piste à une première vitesse et extraire ladite information à une deuxième vitesse, ladite deuxième vitesse étant inférieure à ladite première vitesse ;
- des moyens de détection (152) pour détecter le début d'un premier bloc de signal présent dans le signal extrait de la piste ;
- des moyens de production d'adresse (148, 149) pour produire des adresses d'entrée de lecture à ladite première vitesse et pour produire des adresses de sortie de lecture à ladite deuxième vitesse, et
- des moyens de comparaison (156) pour comparer un degré de remplissage des moyens de mémoire à une valeur de seuil (T_a) ;

en ce que les moyens de lecture sont propres à effectuer les étapes suivantes :

(a) les moyens de production d'adresse sont propres à produire des adresses d'entrée de lecture successives à ladite première vitesse et des adresses de sortie de lecture à ladite deuxième vitesse, en commençant par une adresse de début, pour stocker l'information dans des emplacements mémoriels successifs et extraire l'information de ceux-ci dans lesdits moyens de mémoire ;

(b) **en ce que**, lors de la détection du début d'un premier bloc de signal présent dans l'information extraite de la mémoire par les moyens de détection, un signal de validation est produit de manière à permettre à l'unité de décodage de commencer à décoder l'information correspondant audit premier bloc de signal ;

(c) **en ce que**, lors de la détection du degré de remplissage actuel étant supérieur ou égal à ladite valeur de seuil, le stockage de l'information dans lesdits moyens de mémoire est arrêté, et **en ce que** les moyens de lecture sont propres à revenir à

(a) en réaction à l'arrêt du décodage dudit premier bloc de signal.

24. Montage de reproduction suivant la revendication 23, **caractérisé en ce que** les moyens de lecture sont propres à redémarrer l'étape (a) si, durant l'étape (a), le degré de remplissage actuel atteint une deuxième valeur de seuil.

25. Montage de reproduction suivant la revendication 23 ou 24, **caractérisé en ce que** le signal vidéo réduit en données est un signal vidéo du type MPEG, les premiers blocs de signal dans le signal vidéo du type MPEG comprenant une information vidéo à codage intra-image du type I.

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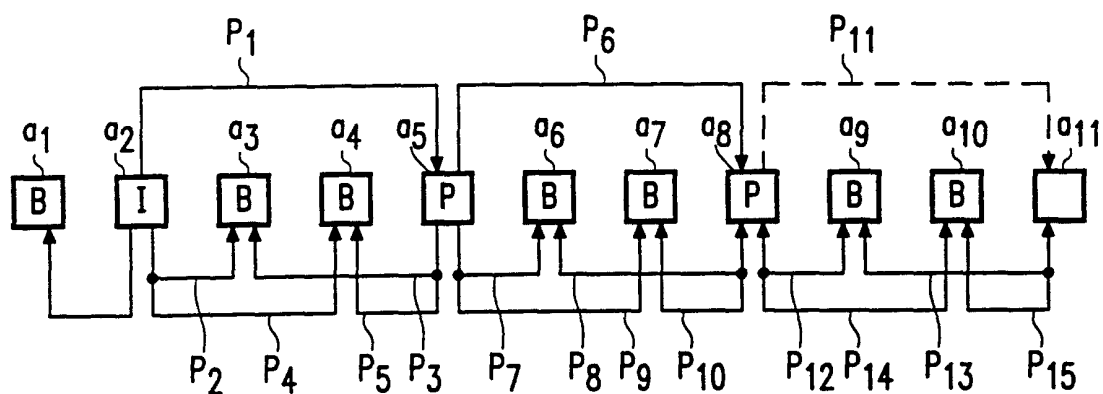


FIG. 1

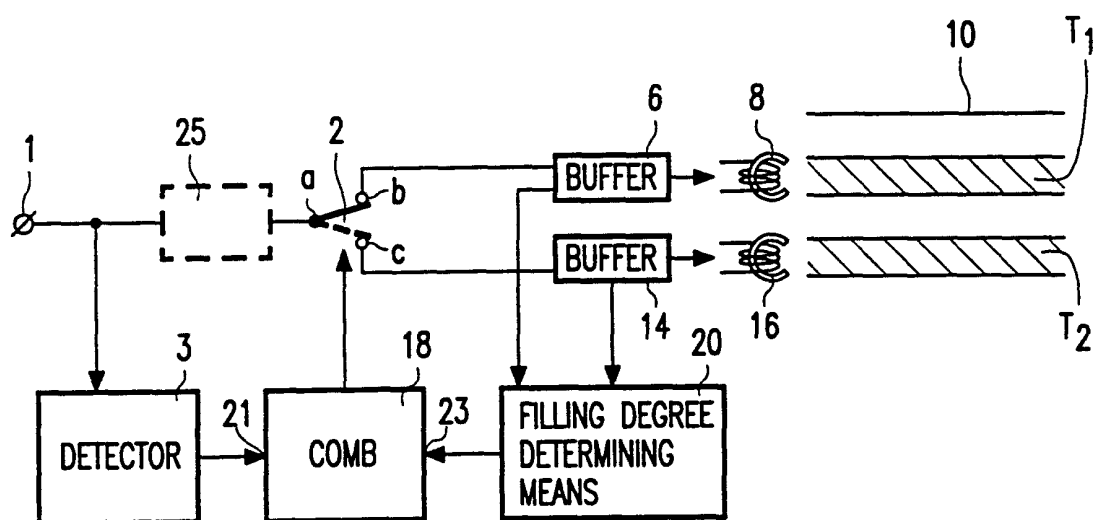


FIG. 3

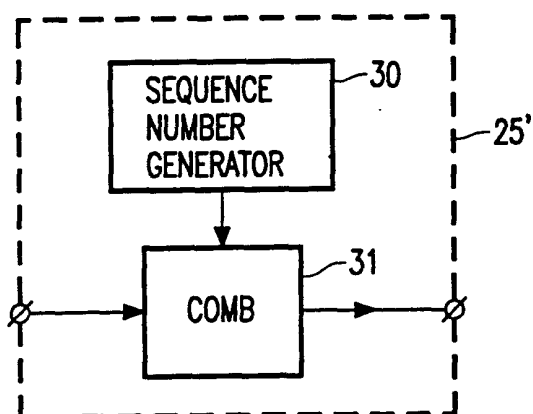
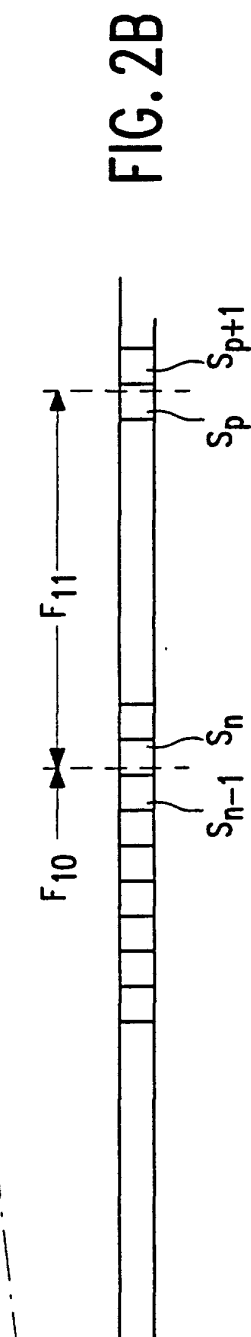
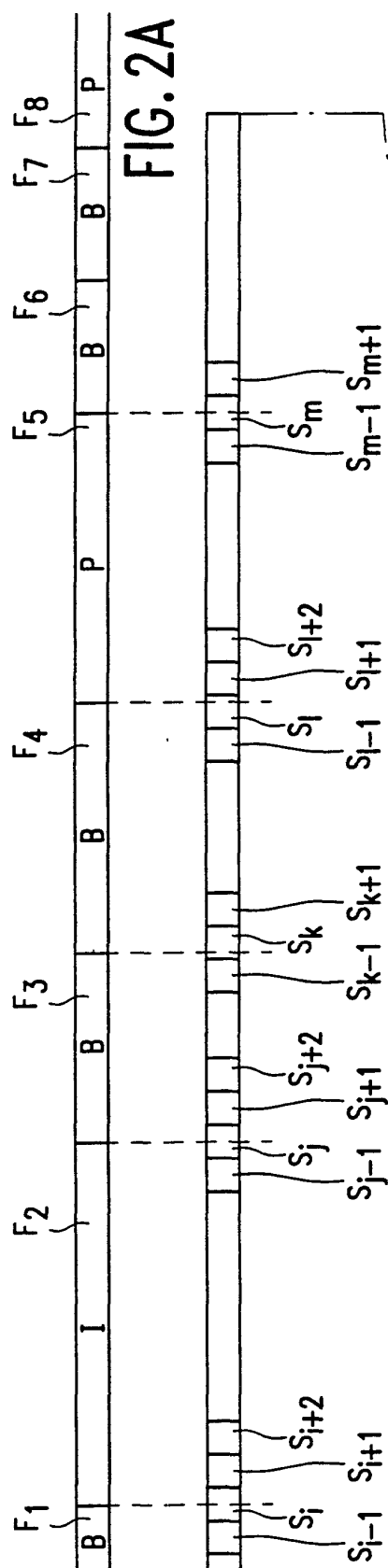


FIG. 4



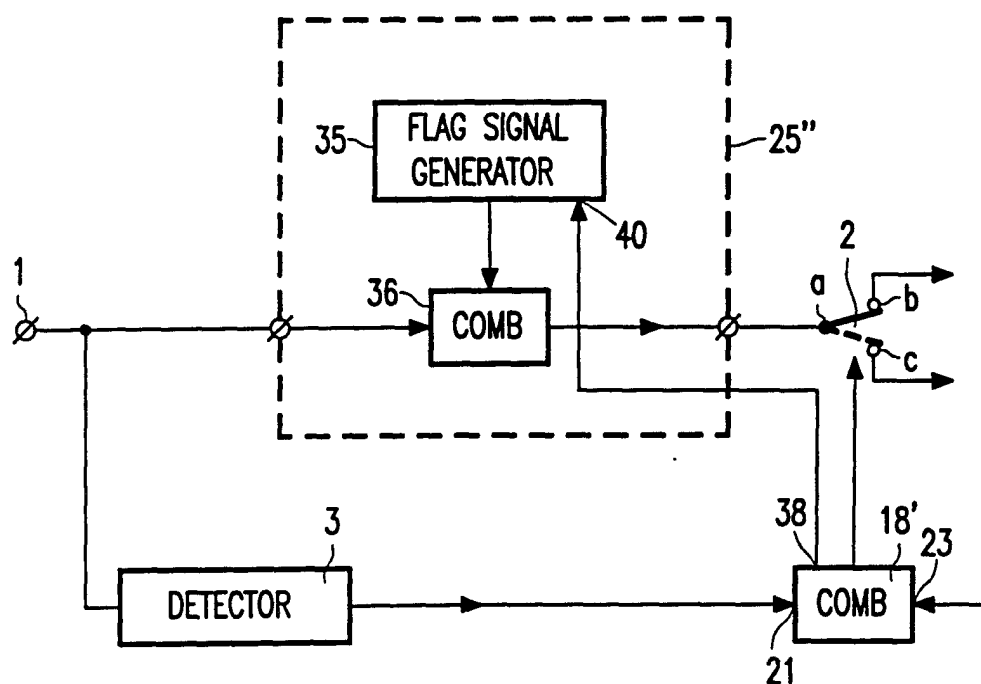


FIG. 5

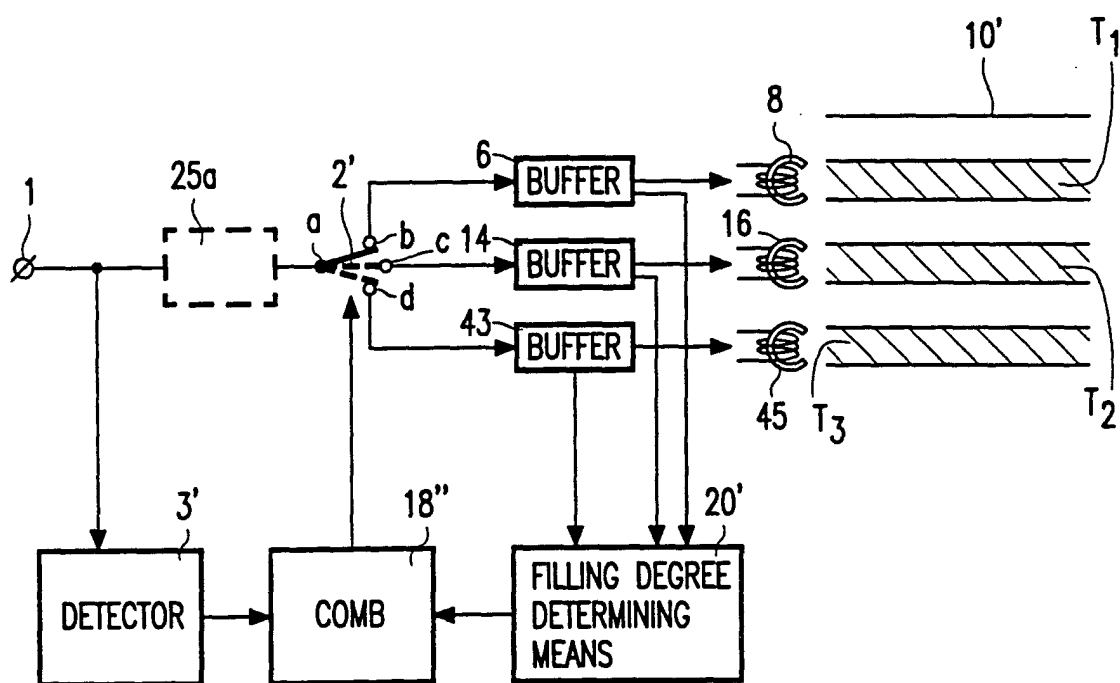


FIG. 6

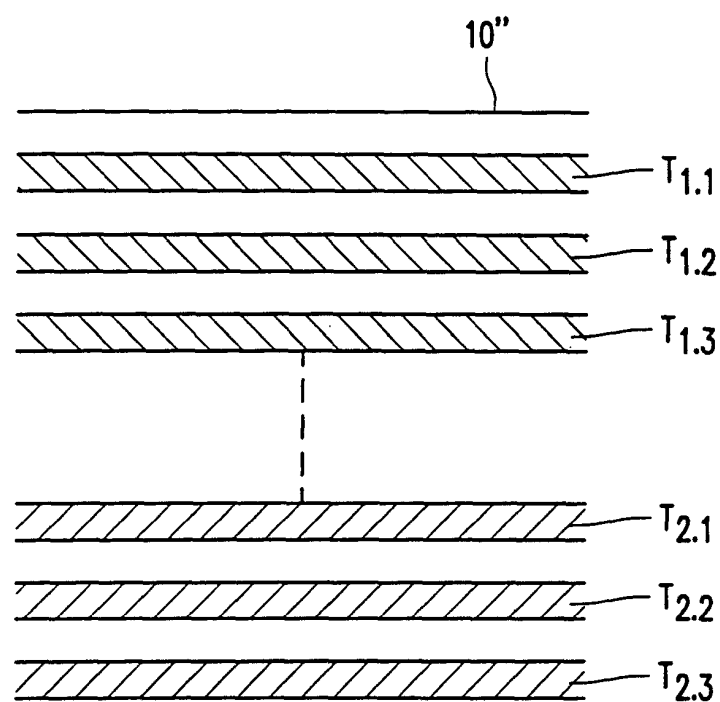


FIG. 7

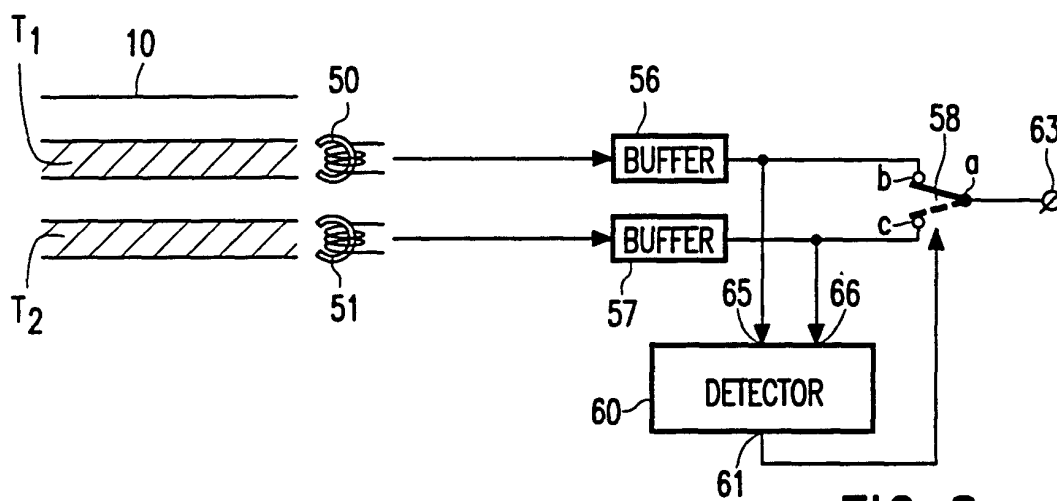


FIG. 8

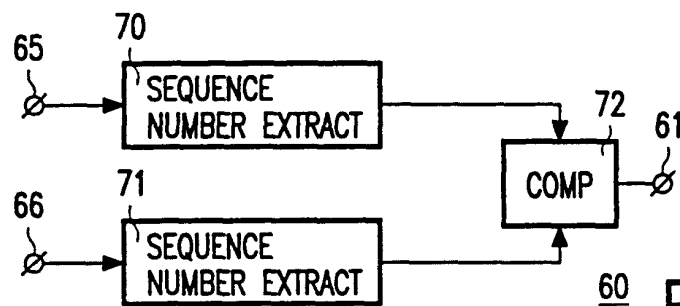


FIG. 9

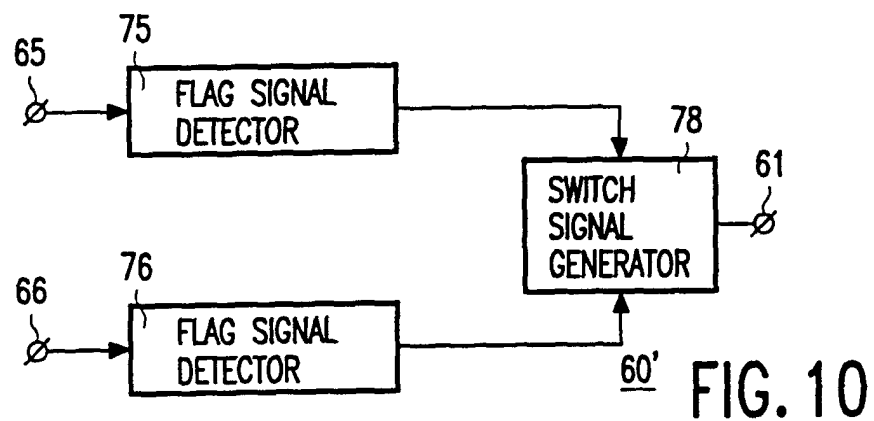


FIG. 10

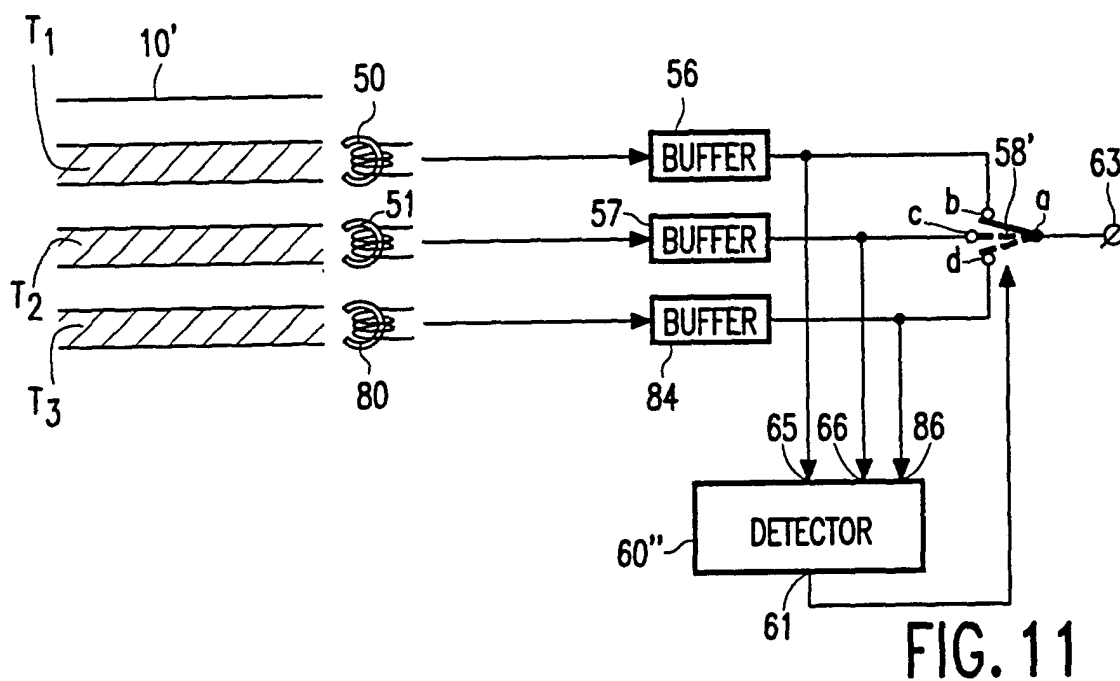


FIG. 11

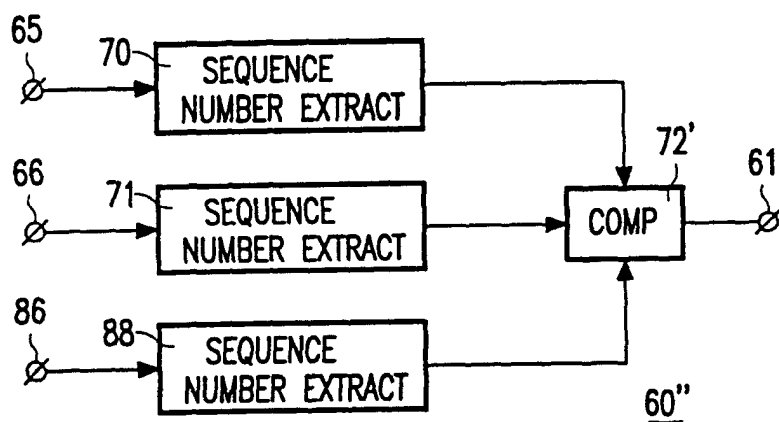


FIG. 12

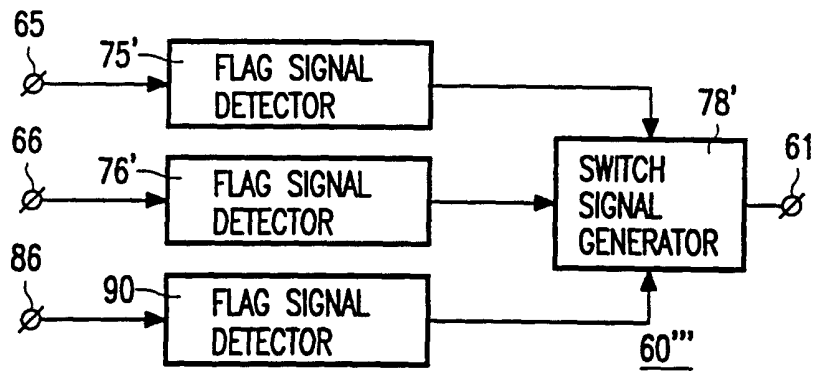


FIG. 13

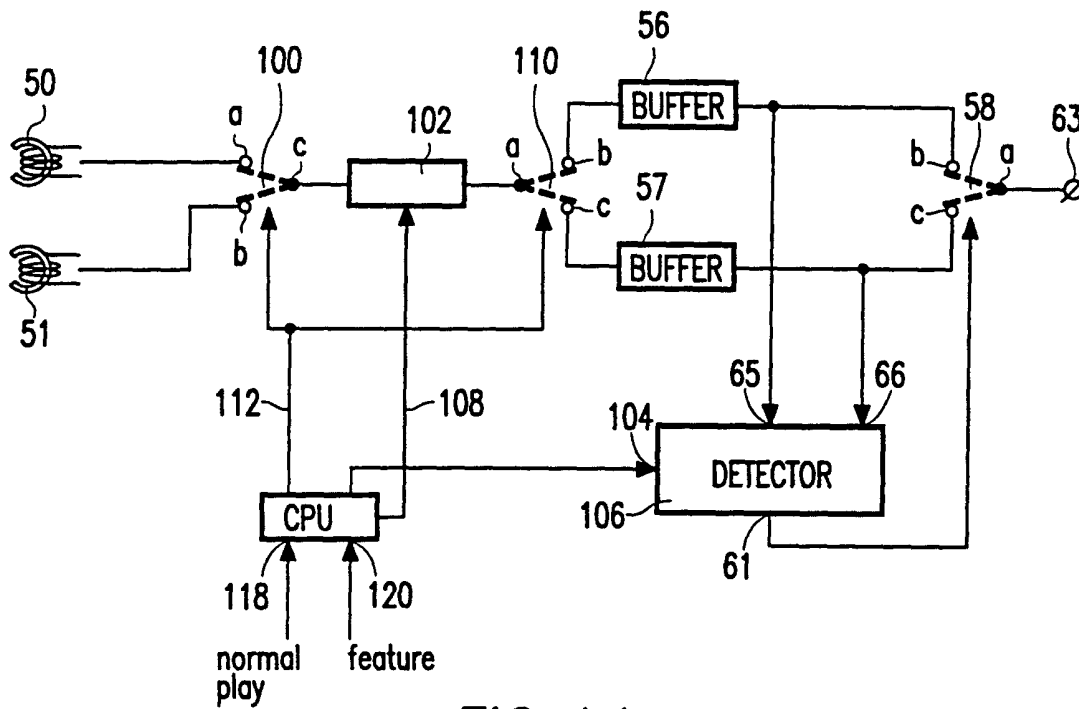


FIG. 14

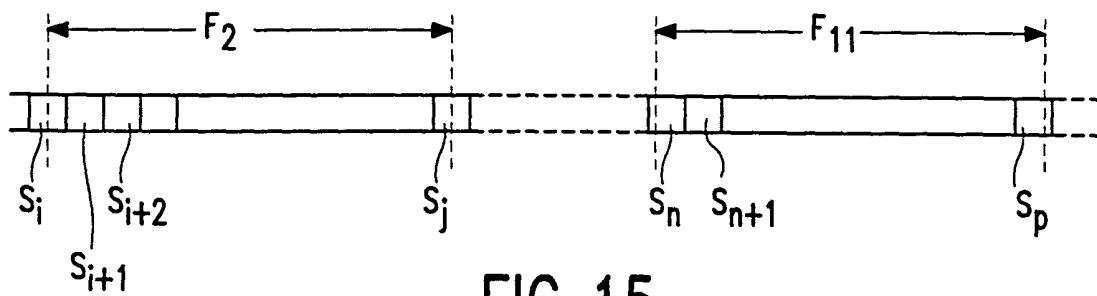


FIG. 15

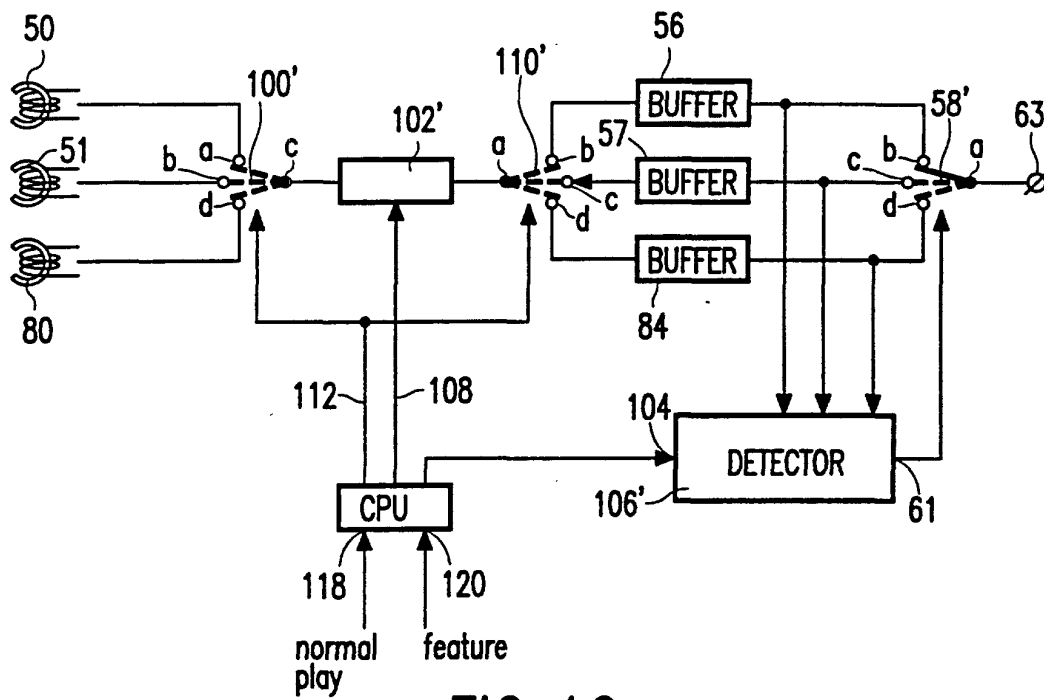


FIG. 16

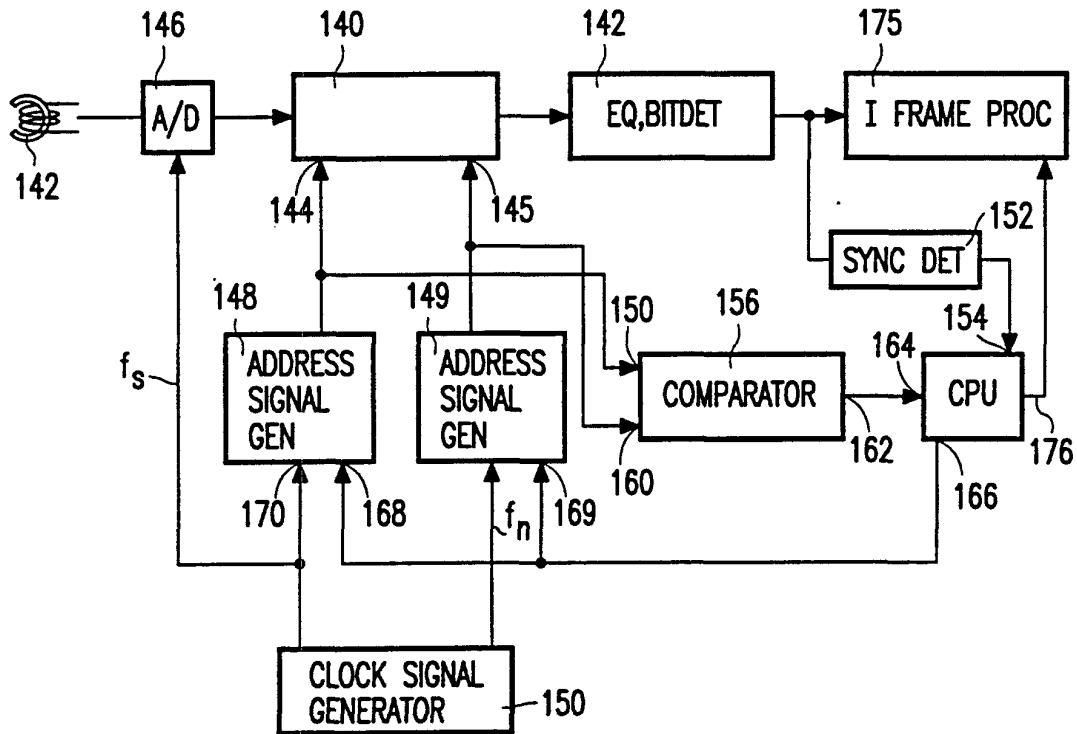


FIG. 17

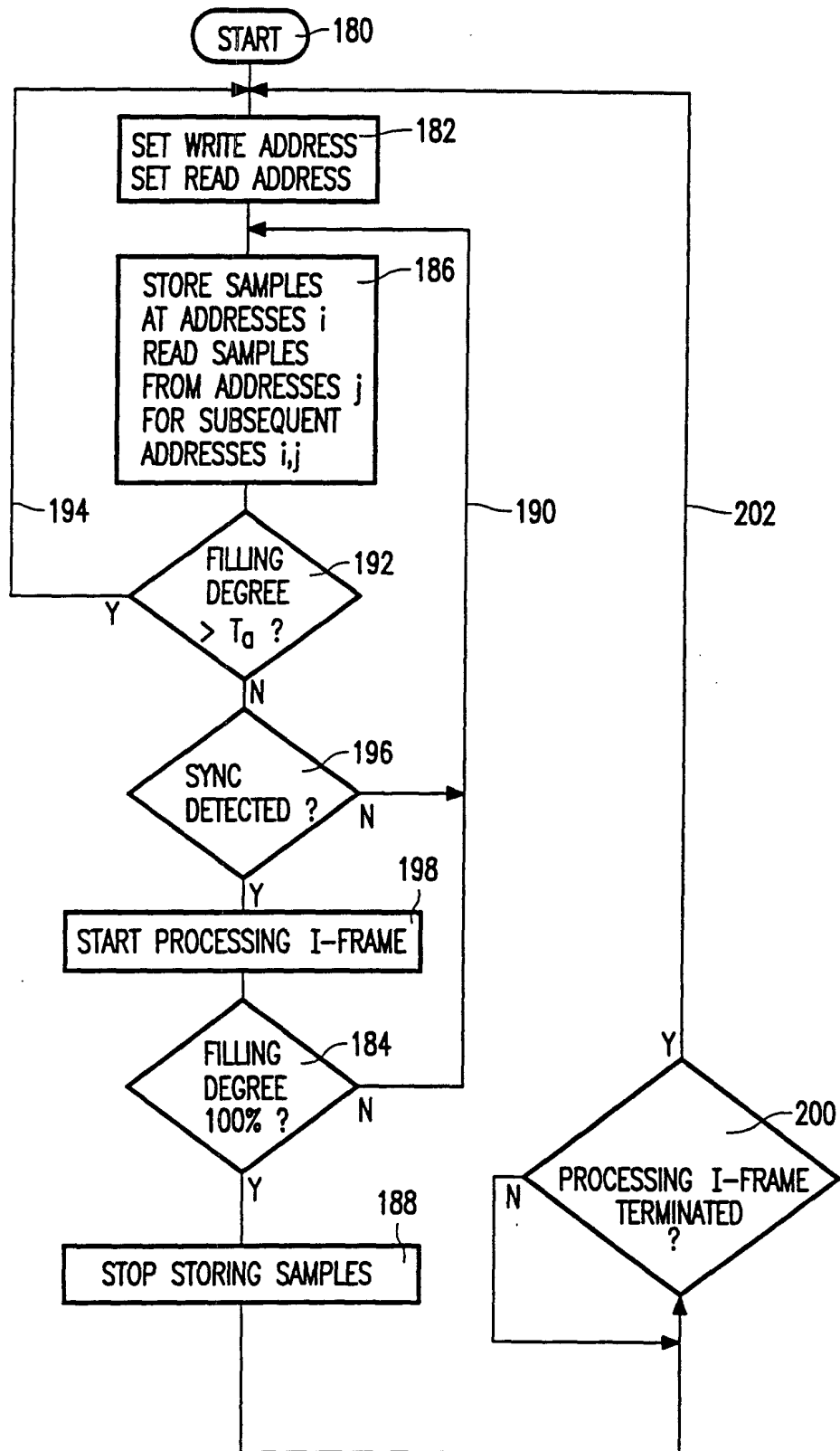


FIG. 18